

AVIATION WEEK

A MCGRAW-HILL
PUBLICATION

September 9, 1957 50 cents

Army Launches
Helicopter Cost
Cutting Program

Convair F-106



Special Report From Farnborough

AIRBORNE SYSTEM CAPABILITY



The Research and Development group at Rhein Armco is currently engaged in the conception, evaluation and design of advanced airborne systems.

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- PROPULSION SYSTEM ANALYSIS

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All requests held strictly confidential.

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How to cope with an avalanche of urgent data
Tape keeps ballistic missile tests in manageable form



Four of the Ancolex, Inc. Ampex FR-100 (Five Transport) General Electric Missile and Ordnance Systems Development Facility in Philadelphia.

Nobody wants to get bored, drowsed, self-focused or tripped as the floodgates open on one of the biggest of all data-acquisition programs. For its ballistic missile development contracts, General Electric's Missile and Ordnance Systems Department has established a data-recording and computation center to match the challenge.

A PREFERENCE FOR TAPE

Of the test information received, about 90 percent will be on tape. Two facts about magnetic tape recording help keep the flow mass of information under control: (1) hundreds of simultaneous parameters are recorded on one tape with a common time base; (2) tape gives live electrical voltage, hence reducing, converting, computing and freezing steps on its done automatically. General Electric's goal is to provide all interested engineering groups with both analog and computed data within three days of receipt of raw tape.

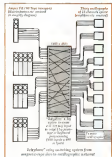
Tapes from flight test, ground test and component development will be received from sources all over the U.S. These tapes will include engine, fuel and air-lack widths. Hence most "tape stores" in the data-reduction system will have three Ampex FR-100 tape transports for the three widths. They will share electronics.

NOVEL USE OF A TELEPHONE TECHNIQUE

The right data must get to each of a large number of research and design groups. No traffic would be allowed — to General Electric's engineers have made ingenious use of taped data's electrical form. They use a "telephone central station." After the necessary conversion steps, hundreds of channels of data from magnetic tape are fed into an automatic relay switching system. The connect

three into 450 channels of oscillographic without (30 oscillographs with 15 channels apiece). When desired one signal can go through a multiple relay putting the same data trace on two or more of the oscillograph records. Programming is done by a carefully checked paper tape. The end result is total traces in a desired side-by-side relation. And each oscillograph record contains the data of interest to particular engineering groups.

Magnetic tape comes to life mainly in computation. The visual records are checked wherever special computer effort is required. Another group



of Ampex FR-100 Tape Reproducers plays the tapes through a high-speed analog-to-digital converter which in turn feeds and converts selected sections to digital form at a rate of 45,000 conversions per second.

If more of data is your problem, we would be pleased to discuss some practical answers. Or would you like to have this information of areas needed direct? For either request, write Dept. 4479.

MAGNETIC TAPE APPLICATIONS BY AMPEX

7

See page 17



Ampex FR-100



Ampex FR-100



Ampex FR-100



Ampex FR-100



Ampex FR-100

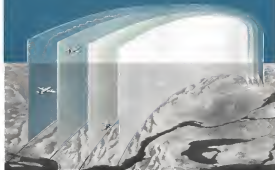


Ampex FR-100

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Fixed wing aircraft and helicopters can maintain holding patterns with absolute accuracy and can land into an approach system from any point with complete certainty.



AVIATION CALENDAR

- Sept. 3—Annual Convention of the ON-1 Club, 11801 Phillips Avenue, City, Mo.
Sept. 1-11—Crossed Aerial Course on Seaboard, Cadiz, Massachusetts. Inauguration of Donkey, Castle, Mo. Main.
Sept. 9-11—15th Annual Meeting, Education, Aerospace Society for Training, Massachusetts Institute of Technology, Cambridge, Mass.
Sept. 9-11—17th Annual Instrumentation Conference, and Exhibit, Cleveland, Ohio.
Sept. 10-11—First Regional Business Aircraft Safety Seminars, Jack Tar Hotel, Columbia, Tex.
Sept. 15—Summer Space Flight Meeting, American Astronautical Society, Room 401, Massachusetts Institute of Technology, Cambridge, Mass.
Sept. 15-16—1967 Gordon Park and Flying Display, Royal Air Force, Farnborough, Hampshire, England.
Sept. 19-20—Business Aircraft Operations Symposium & Exhibit, Grand Hyatt, New York.
Sept. 21—1967 Pacific Area National Meeting, Aerospace Society for Training, Massachusetts Institute of Technology, Cambridge, Mass.
Sept. 21-22—1967 Western Aircraft Maintenance and Operation Conference, San Diego, California.
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AVIATION WEEK ■ SEPTEMBER 7, 1967

Vol. 40, No. 12

Aviation Week is an annual event for the aviation industry. It is a time when the industry comes together to discuss the latest news and developments in the field. The event is held in New York City and is attended by thousands of people from all over the world. The event is a great opportunity for the industry to network and to learn about the latest in aviation technology.

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TRANS-SONICS
INCORPORATED

Dorchester, Massachusetts

- (Continued from page 5)
- Sept. 18-20—North Great Lakes Region Civil Aeronautics Club Air Field Two Hours Behind Great Lakes Civil Aeronautics Club
- Sept. 20-Oct. 1—National Aeronautics Meeting Aircraft Production Forum & Aircraft Engineering Display Society of Automotive Engineers—Detroit, Michigan—Los Angeles
- Oct. 2-6—1948 Annual Meeting and Dinner—National Business Security Year—Commodore Hotel—Denver, Colo.
- Oct. 3—F-46 Annual Vehicle Inspection Society of Experimental Test Pilot Society—Indiana Hotel—Los Angeles
- Oct. 7-9—1948 Annual National Electronics Conference—Chicago, Ill.
- Oct. 7-10—Technical Symposium, Army Flight Programs Laboratory—Cleveland
- Oct. 7-12—Flight Annual Congress, International Aeronautical Federation—Barcelona, Spain—Hotel Astor—NY, 17 Laurel St., Concord, Mass.
- Oct. 8—1948 Annual Report Development and Operations Conference, Oklahoma Hotel—Lawton, Okla.
- Oct. 9-11—National Fall Convention, Society for Experimental Race Analysis, El Centro Hotel—San Diego, Calif.
- Oct. 10-15—National New Materials Symposium, Sherman Hotel—Chicago, Ill.
- Oct. 10-15—Conference on Computers in Guided Aircraft, Institute of Electrical Engineers, Chalfonte-Haddon Hall Hotel—Miami, Fla., N. Y.
- Oct. 10-16—1947 IRE Canadian Convention, International Building, Exhibition Park—Toronto, Ont., Canada
- Oct. 17-19—1948 Annual Convention, The Mechanics Association—Baltimore Hotel, New York
- Oct. 21-23—Canadian Aeronautical Institute Institute of the Associated Services Meeting—Montreal, Canada
- Oct. 20-23—Conference on new Aviation needs in the field of power, American Society of Mechanical Engineers—Aeromechanics Hotel—Allentown, Pa.
- Oct. 21-25—1948 National Safety Congress, General Motors Hotel—Chicago
- Oct. 24-25—1948 Annual Meeting, Aeronautical Electrical Equipment Aircraft Electrical Society, Pan Pacific Auditorium—Los Angeles, Calif.
- Oct. 25-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel—N. Y.
- Oct. 25-26—1948 Annual Meeting, Association of the U. S. Army, Sherman Hotel—Washington, D. C.
- Oct. 25-26—Annual Fall Coast Conference on Aeronautical and Navigational Electronics, John Raymond Aeronautics Building—Alb.
- Oct. 28-31—National Industrial Packaging & Handling Exposition—Atlantic City Convention Hall—N. J.
- Oct. 29-November, Electrical Engineering Display, U. S. Coast Hotel, San Diego
- Nov. 1-7—Joint Military Industry Guided Missile Reliability Symposium, Limited to those with Secret security clearance—Naval Air Station Test Center, Ft. Meigs
- Nov. 6-8—Third Annual Symposium on Aeronautical Communications, Wald Sea, U.S.N.S. Y.



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Hayes has not received any formal citation in recognition of service rendered during our first year's dealings with the United States Army. But we like to believe that the integrity of Hayes Aircraft Corporation has been recognized in a more material way—renewal of our contract for daily inspection and maintenance of all aircraft at the Army's immense training center at Fort Rucker.



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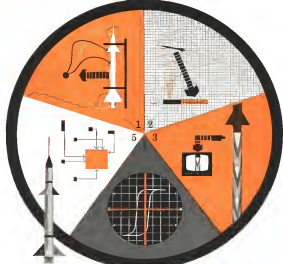


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When the tip sublimes I

Away up where it's cold, black and lonely at 300,000 ft., the thermal attack on a missile or "airplane" isn't very meaningful. The air molecules at that height are barely adding friction, rather than crumpled together in a fluid mass that, ramps and re-enters into the earth's dense envelope of atmosphere generate thermal attacks of lightning force. Nose and leading-edge temperatures may rise to 3000°F.

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PRESSURE SWITCH

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COVERS THE FULL RANGE
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PERCENTAGE OVERPRESSURE (CALIB.)	16 to 20 psi	4.25 to 6 psi	2-12 psi	12-18 psi	12-100 psi	125-1000 psi	100-2000 psi	2500 psi and over	
ADJUSTMENT RANGE OF THE SWITCH	0.1 to 1	0.1 to 200	0.1 to 100	0.1 to 100	0.1 to 100	0.1 to 100	0.1 to 100	According to 3000 psi setting at lowest pressure	
MAX. PRESSURE (WITHOUT EXCESSIVE HEAT)	800 psi	100 psi	750 or 4.500 psi (30 REQUIRED)	750 or 4.500 psi (30 REQUIRED)	750 or 4.500 psi (30 REQUIRED)	4.500 psi	4.500 psi	150 psi	
SWITCH MEDIUM	750 psi	450 psi		1.500 or 7.500 psi (as required)		2.500 psi	2.500 psi	450 psi	
SWITCHING RANGE				—30 P.S.I. to —250 P.P.					
WEIGHT	By 2.000 psi at 50 C. Switches 100-10000 Pressure 1								
OVERALL DIMENSIONS	Switch Pressure — 2" Diameter Length 1 1/2" Mounting Bracket to Full Adjustment							2 1/2" width 2 1/2" height	
WARRANTY PERIOD	5 Years							12 1/2 Years	12 Years
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For an interesting discussion of the broad subject of "Reliability," write for Cannon Bulletin B-1.



Special Report On Fairbairn

► British policy shift to missiles may be premature, SBAAC display suggests

U. S. Face Policy Hit At IATA Meeting

► References to "unilateral" action on S1: fare increase applies to CAB action, economic plight cited

Army Begins Cost Cutting Program

► Results of 5,000 test are estimated test points way to helicopter savings

MISILE ENGINEERING

New English Missile	21	Air Force May Be Near For DC 15	42
British Protest BSAAC Shows	22	AA Approval For Chicago Route City	42
Army Fight For IRBM	48	Search To 100: Airway	45
IRBM	48	SEA Spiders Count 20%	45
AIRCRAFT ENGINEERING		AA 100: Aerial Slick	45
New Russian Fighter	38	Alaska City Airport	47
Yakov F119: Features	39	After Steeper	48
Soviet-Czech Engine Shows 70,000 Ft.	39	Shorborn	48
Engine Engine Program	43	Chapultepec	51
Army Tank Equipment	47	EQUIPMENT	
Specimen Road For Test	50	ILAW Pilot's Never Controlled	117
Reaction Press Air Test Force	45	CR The Line	118
Structure Tested on Ground	46	FLIGHT	126
FLIGHT ENGINEER	52		

AVIONICS

Mark 8 Cooling Techniques	24	Light Search System 800	22
Wave Air Safety System	41	Site: Power Unit 2E	29
F Engine Heat Transfer	111	Thompson To Berlin	47
Missiles Control	113	Standard System, 84%	43
		Track System Management	73
		Wings: Where	22
		Industry Observer	32
		Washington Develop	25

BUSINESS FLYING

Turkmen Transport	121	SAFETY	
Private Jets	141	Calendar	143
		October	148
		DEAF Carriers	126

FINANCIAL

Army Contracts	106	EDITORIAL	
ABC Contracts	107	Missile Milestones	21
DEAF Carriers	104		

EDITORIAL

Missile Milestones	21
--------------------	----

COVER: Cannon F136 as proposed. If weather interceptors show here during flight tests at Edwards AFB in an advanced version of the original F136A program, it will have with Air Defense Command. F136 is proposed for a Post & Warner JTI network with interceptors producing about 12,000 lb thrust. It is a clipped vertical fin and was designed as a table design. It will carry the Douglas M51 air-to-air missile with down vertical and operates in the Mach 2 speed range of interceptors in the 60,000 ft. area. It is scheduled for production at Cannon's San Diego plant. Additional photos on page 32/33.

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Missile Misinformation

Seldom has the American public been misinformed by such a flood of misinformation from official government sources and the daily press than during the two weeks since the Soviet Union announced the successful test firing of an intercontinental ballistic missile (AW May 20, p. 31 and Sept. 1, p. 27).

The flood of missile misinformation is a subject of vital importance to every American citizen and the future of our country is the inevitable result of the public information policies of the Pentagon dictated by the White House during the past three years.

Citizen in Dark

These policies are based on the philosophy that the American citizen whose vote elects the government and whose hard earned tax dollars finance its activities has no "need to know" law, civility or will be money is being spent to provide him with an adequate defense against possible foreign enemies. The White House has changed as soon customs of secrecy to Pentagon release of almost everything concerning the vital ballistic missile programs that now includes the Air Force, Navy and Army. This is a program that is absorbing billions of the taxpayer's dollars and to date has produced nothing worth-while other than notwithstanding in the way of metal military hardware.

Certainly the American people have a need and right to know within the limits of genuine technical secrets what is being done with this money and what we can expect to get for it. Both USAF and the Army have made strong representations to the Secretary of Defense and the White House that the narrow light access policy on the ballistic missile program is neither effective nor wise. But they have been rebuffed by the "pappa knows best" attitude emanating from the executive branch of the government.

Officially Misleading

Official government statements on the Russian ICBM firing have been deliberately misleading and withheld a good deal of information the American people are entitled to have on the subject. These official statements by President Eisenhower, Secretary of State Dulles and Deputy Defense Secretary Quarles have been manipulated solely for political effect with a technique that we expect from the Kennedy but not from the White House. In fact Mr. Quarles' note to USAF budget expenditure has become quite explicit in publicly disclosing actual facts without actually disclosing them.

The White House and Pentagon knew when the Russian began their ICBM test firing program, the known approximate how many missiles have been fired to date and the general performance characteristics of these missiles in altitude and range. This also knew how long the Soviets have been firing intermediate range missiles, where these test firings have been made and the general progress of the program. These are certainly not facts that need concealing from the Russians so why conceal them from the American people? Even the methods by which this information is secretly being collected is known to the Soviets and there is little this can do except bluster to stop this process.

If we are running neck and neck with the Soviets in the next major round of a space development the American people are entitled to the unvarnished facts on what this country must do to stay significantly ahead of any competition in this field. No amount of official tooth and tongue will remedy this situation.

Florida Force

Another ridiculous aspect of the official information policy on missiles is the force being cranked up on Florida beaches near Cape Canaveral with increasing frequency. Large ballistic missiles and research vehicles are being launched in plain view of hundreds of million observers who now plan their parties to coincide with the missile firing. Canaveral is all sorts like their knowledge and need the successful flights out of sight or the ignorant bearings on the pad at destinations is dark night by the range safety officer.

Yet official policy has its hand behind the back in Florida and like an ostrich and takes the attitude that these firings are top secret and nobody knows as things should be. In the case of the abortive Atlas test firing last June this reached a climax of absurdity. Missions files taken from public beaches only a few miles from the launching pad were shown two days later in 500 newspapers and a host of news items, available all over the world technical experts could reconstruct all significant detail of the missile's operation, the type of fuel being burned, the exact component that failed and many other details. So who are we kidding about what's secret in our ballistic missile program?

Official missile information policy needs a thorough realistic review aimed at giving the American people all the facts on both our progress and those of the enemy that are consistent with maintaining genuine technical secrets. Any other policy is leading toward defeat and eventual disaster.

—Robert Hertz



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Circle 2, p. 22 of this issue.

TITANIUM PROGRESS IN FLIGHT

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WHO'S WHERE

In the Front Office

Dwight A. Benson, executive vice president, The Twine Kelly Spring Co., Garden City.
Walter G. Cole, vice president-administrative and finance, Ditch Lumber Co., Vernon, N. H., vice president-manufacturing equipment, Portsmouth Equipment Co., division of International Telephone and Telegraph Corp., Fort Wainut, Ind.
Gregory F. French, Jr., vice president for Europe (France), Northrup International, Northrup Aircraft, Inc., Burbank, Calif.
Arthur F. Fritsch, vice president-aircraft projects, Idaho Leland Machine Company, Denver, American Machine & Foundry Co., Denver, Ohio.
Gravel J. McCord, vice president-manufacturing and service division, and Miss G. D'Amico, vice president research and development division, Staatsair, Ansonia, Conn., Torrington, N. Y.
Richard A. Wilson, a vice president and head of newly formed Young's Group, Detroit, Inc., San Francisco, Calif.
Theodore Vuolteen, general manager in Investment Division, General Corp., Detroit, Mich.
Carl Robert L. Johnson (USAF, ret.), assistant to the president, Advance Industries, Inc., Cambridge, Mass.

Honors and Elections

The Aircraft Manufacturers Council of the Aircraft Industries Association has announced the following elections: **Lester Reynolds-Grove M. Barker**, board chairman and president of the Martin Co., chairman and **John S. McInnes**, president of McDonnell Aircraft Corp., vice chairman, Western Region—**J. J. McCulla**, board chairman of General Aircraft Aircraft Co., chairman, and **William M. Allen**, president of Boeing Airplane Co., vice chairman.
 The Traffic Relations Sub-committee Chairman of the Aircraft Industries Association also announced the following elections: **Lester Reynolds-Grove M. Barker**, director of advertising and public information for Sperry Gyroscope Co., chairman, and **William C. Ray**, member to the president of Fairchild, vice chairman, Southern Corp., vice chairman, **Walter Reynolds-A. W. Chubb**, director of public relations for Northrup Aircraft, Inc., chairman, and **Leland R. Fisher**, member to the president of North American Aviation, Inc., vice chairman.

Changes

Er. Coals, D. R. Gresham has joined the staff of General Electric's Flight Propulsion Laboratory, Aircraft Gas Turbine Division, Cambridge, Mass. Gresham previously formerly headed the Bureau of Aircraft's high speed test Project 22P, one of the largest projects ever undertaken by the firm.
Thomas Walle, a veteran of the war test industry, has joined Thayer-Violet E. Stronach, Los Angeles, Calif. (private) and industrial specialists to solve the engine industry.

INDUSTRY OBSERVER

(The following column is written by AVIATION WEEK editor attending the 1954 BRAC Flight Display at Farnborough and the Joint Technical Conference of the Royal Aeronautical Society and the Institute of Aeronautical Sciences in London.)

- English Electric P.3 production fighters will be armed with a pair of de Havilland Firestreak missiles installed as short fuselage pylons on the fuselage side rails and slightly aft of cockpit. Possible blind and their problems are expected. Assessment of two Missiles. Area engine has been installed and tests at the cannon have been made on one of the prototype P.3A aircraft.
- Unofficial height record established last week by a Canberra test bed powered by standard Rolls-Royce Avons plus a pair of Napier Scorpion rocket engines in the belly was actually set on the fourth of four runs as well above the current official mark. First of the runs was a rehearsal, second a confirmation of the ability to make the altitude. Third run was officially achieved, but crews reworking equipment malfunctioned. Fourth run has been abandoned for investigation. This attempt is expected to be officially confirmed as altitude several hundred feet in excess of the 70,000 ft level announced.
- First squadron of Vulcan Supersonic Strategic nuclear strike fighters is forming and is expected to be fully equipped by next month. Plans are developed to Royal Navy operations for tactical delivery of atomic weapons over long range operating from carrier decks with target range at low altitude.
- Aero-elastic flutter has improved turbine performance compared with no flutter in the engine exhibited at Farnborough. Vortex generated has been fitted to ribs and wings of Glanby (a-44). Also Vulcan, Vulcan Variant and some of the English Electric Canberra engine test beds. Best trailing edge devices appeared on the Indigo and the English Electric P.3 series of fighters. Nettleby (a-44) was the first turbojet with wings and its jet exhausts controlled Swedish five 13 axial compressor (jet exit reflect engine) compressor.
- Delimitation of Firestreak missile, now standardized as assessment for the P.3, Jetcraft and de Havilland Sea Vixen, are not yet keeping pace with the requirements for tactical missiles. At least one being working method to the missile in writing is its development work for delivery of enough rounds to start an adequate test program. Most of the two dozen individual rounds shown at Farnborough in the static display or fitted to the firing assembly were obviously dummy or mockups of the de Havilland air-to-air missile.
- Watch for announcement of a major airframe order for extension of Lockheed Constellation to Napier Ejector turbo-propellers. Napier has contract contract for REAL, orders of Bristol for construction of its Conquest turbo-propellers.
- Technical advances rate the Bristol Bloodhound management self-actuating missile as one-rocket comparable to the Western Electric Nike in usage and performance, but give a slight edge to Bloodhound performance because of its auto-rotational development cycle. Bloodhound is not yet used in the United Kingdom for defense of target area, Nike missiles have been operational in the United States for several years now and cover many American cities.
- Royal Air Force announcement of order for English Electric Thunderbolt subsonic missile gives the impression not that weapons over the Bristol Bloodhound for future delivery will. English Electric is now on the postcard of making the major contribution to British air power with its aging but still potent Canberra multi-mission heavy bomber in the form of British Commonwealth tactical strength and the P.12 supersonic reconnaissance as the future member of lighter Command along with the Bloodhound missile for the air defense of England.



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Washington Roundup

Information Gog

Watch for increasing efforts to spotlight the Open House Commission based in the real pig on adequate public information at the Pentagon. Defense Secretary Charles E. Wilson and Admiral Smedley, his assistant for public affairs, are barred to limit the direction and try to control them, but the real eyes are to bring Americans when they stand at the ballistic missile race (see page 80) come from OGB, a watchdog for the White House. The board was created by President Eisenhower to see that his orders are carried out and that includes selecting his strong opinion to letting the public in on military business. USAF officials gaged in the current battle over capabilities and the state of the missile air, recognizes that OGB is raising the stakes. Many hope appears to be that great observations of the risks will result in conclusions on other areas that violate them.

Then, at little possibility that public opinion can force a change in OGB's advice. Board is somewhat, highly political, seldom published and accessible only to the President.

Mass Hearings

Defense Department public information policies, generally the highest of information, is mainly to be opposed to the public's need to know, will be available at open hearings before the House Government Information Subcommittee Hearings on Intervals, scheduled to begin Nov. 15. The key witness will be Assistant Secretary Smedley (John Mear, Jr., C.I.D.), chairman of the group, who sharply criticized Smedley for his stance justifying the disclosure of any details on foreign except confirmation of the fact that a king occurred and "a brief statement" to see whether in the event of an accident.

Transpacific Reopened

The CAB is being asked for the second time to let them three years to reopen the Transpacific Air Route Case to consider Pan American World Aeronautics to be over Portland and Seattle on the Great Circle route to the Orient. The request by President Eisenhower was made one month and one day after the President had approved the CAB recommendations during Pan American's application, but which permitted the airline to fly direct from California to Tokyo on the route. The President said it had come to his attention that there was, but he had refused to exercise on traffic and other Northwest Airlines might divert flights from the West Coast through Minneapolis and Alaska. In case of this, he said, "I leave the board to prepare and submit to me for my approval an order imposing Order No. 5571 to the Israeli extent of deferring final decision on Pan American's request to use Seattle and Portland on the Great Circle route."

New Name For Holloman

Name of Air Research and Development Command's Holloman Air Development Center at Holloman AFB, N.M., has been changed to Air Force Missile Development Center—Roswell, said Air Force spokesman who "we develop rockets, not air."

Members of the center as well as management of missile weapon systems through ARDC's Bolivar, Monte De Visión at Los Angeles and headquarters offices located at Wright Air Development Center, remain unchanged.

Small Business Review

Small Small Business Committee wants the Air Force to make a survey of all its weapon system contracts. To determine what and previously-provided improvements the contractors have begun to manufacture in that one plant, since being assigned management responsibility for a weapon system.

USAF also has called on to require contractors to submit their subcontracting requirements to the 11 USAF district offices. Thereby eliminating the necessity for multiple manufacturing, similarly, to contract with weapon system contractor, similarly, to contract with weapon system contractor in its report. "Recent years have brought an undue lessening of the registered priority of military contracting offices to less toward the larger manufacturer as producer to doing business with qualified smaller companies."

ATA Rebuttal

Air Transport Assn charged last week that a report by the Basic Airframe Subcommittee suggesting possible contract violation in ATA's activities is "checked full of vague hints and innuendoes, suggesting very little."

The report could be passing little substance, and no support from the word of the language.

Soviet Satellite Visit

Soviet Russia has returned it will attend an inter national conference here on rocket and earth satellite program from Sept. 30 to Oct. 5. Host is National Academy of Sciences.

Chairman is Dr. Lloyd V. Berkner, President of Associated Universities, and reports on rockets and satellites for the special committee on the International Geophysical Year.

The meeting is the first international IGY conference to be held in this country. Other have been held in a dozen countries abroad.

Agenda includes discussion on interchange of data from rocket and satellite experiments among the participating countries, and should produce clear indications of Russia's satellite plans.

Traffic Control

House Interstate and Foreign Commerce Committee is pressing for new air traffic control procedures and strict enforcement of regulations to prevent expanding civil air transport problems. In a report on air transportation and airport use problems, the committee pointed to the collision of a jet fighter and a civil passenger transport last Jan. 15 during test-flight operations at the Los Angeles area as an example of the need for tighter airport control. The committee added that such information has been received in the confusion involved a substance of the report, it not the letter of the Civil Air Regulations, since an effort pertaining to test-flight operations.

—Washington Staff



AVION VULCAN goes into orbit for testing. Photo shows a development of the basic Mk1 version, (top) and Mk2, and the Royal Ordnance version plus altered landing gear incorporating constant speed.

SBAC Display Suggests British Missile

Impressive aircraft performance in flight demonstrations contrasts with unimpressive missiles.

By David A. Anderton

Familiarity—Impressive performance of the English Electric F3 can contrast sharply with the unimpressive appearance of a batch of British missiles at the 1977 Society of British Aircraft Constructors display.

Highspeed passes executed in subsonic speeds by a Mirage III Supple order incorporating some losses at the display, coupled with tight high G turns well within the boundaries of the weapon hall of the field emphasized the aerodynamic capabilities of the F3, listed as the best of the RAF's manned fighters.

Missile Evolution

In prospect replacement of the English Electric Thunderbolt and the British Bloodhound missiles on display in the SBAC park, externally showed an striking, advanced over three American missile counterparts.

The contrast increased the growing belief that the DeLorean Wyre Flyer of last year, which ruled out further procurement of missile fighters and bombers, was ahead of its time by

about one more generation. "Now we can't learn how to build a modern fighter," said one engineer, "we're not allowed to do it again."

Most technical observers, even those who are strong proponents of the missile system, do not feel that the day of the missile has yet dawned in Britain.

Backing up this belief is a continuing series of canceled fighter developments and extensive missile systems to be added to existing aircraft. Foremost among these was the little white Saunders-Roe S7 interceptor using a novel powerplant of an Arrowing Siddeley Viper turbojet and a de Havilland Spectra turbofan engine.

Sci 53 Postures

Light development of the plane by John Booth showed its extremely short tail-off run, near vertical rate of climb and located at eye level height, as positive speed capability. Even though official support has been withdrawn from the P177 development of this plane, the company is continuing development in the hope of foreign foreign sales.

Major restrictions to the day display

was made by military services in 1977: current operational aircraft and missile tests which tend to bring the focus of the event from the Show to the more modern Fighter Command live air operations of 27 Gladius fighters and 27 Hawker Hunters, No. 111 Squadron and its acrobatic team now increased to four Harrier and Sea King Command live over two Avro Vulcans and two Vickers Valeris.

Royal Navy missile flights at a dozen of its Fleet Guard anti-submarine aircraft and an acrobatic team of five Hawker Sea Kings plus one soloist Control Flying School sent a team of four performance Frecos at Princess of Wales to do aerobics in a style reminiscent of general RAF displays at Hendon.

More Stetic Display

Under the canvas roof of the style display, exhibition space has been increased by about half this year to take in the swimming member of some new display rules in the modernization of Britain's air power.

The static park showed those lovely members of the display—the Avro Shackleton, DH Vampire Tutor, the Blackburn Buccaneer—relatives of an even more of friends at Farnborough. As at previous SBAC displays, large pos-



RAMSEY FACE VICTOR, one of the heavy bombers jet beginning, to get into service with the Royal Air Force Bomber Command, comes in for a landing.

Policy Is Premature

Some of the flying was devoted to the search of engine tests, jet tests with a performance of "Climaxer this and" and to civil aircraft including the DH Comet 3 and Bristol Beesbee.

Weapon System Accret

Notable at Farnborough this year was the accent on the weapon system for the first time in these displays, almost every military aircraft and missile was listed as either a weapon system or part of one. But there is still considerable difference between the systems of Britain's weapon system projects and those of the United States where, although the system approach has been borrowed here in a big way and a wide variety of weapon projects.

Present approach to a complete weapon system was the English Electric Thunderbolt anti-aircraft missile. Designed to take advantage of range of existing arm equipment the Thunderbolt has been simplified to a new design program which is the largest in design in England. The missile has an ogive head and cylindrical body tapering slightly to a conical shape over the rocket nozzle of the solid propellant motor. The wings are fixed in a swept area surface. The tail is cross beam and is the same plane as the

wings. Tail surfaces are of movable and provide all control, their aspect ratio is higher than that of the wings. Tail and wings are located quite closely together and the characteristic is great stand-off in the British manner.

Both to a similar acquisition-target area defense—the British Bloodhound has a different kind of geometry, propulsion and guidance system. Bloodhound is also ogive headed and has a cylindrical body, but its propellant is a gas of liquid. This range requires production about 5,000 lb thrust each and designed for speeds probably in the Mach 7.5 range.

Both Bloodhound and Thunderbolt are boosted by a cluster of four strap around solid propellant rockets in a configuration which makes its launch convenient but maintenance critical. First phase of both missiles is main line wings bodies and boosters (overhead). Contained in all of the cluster boosters are those and other British missiles reflect the care at lack of large solid propellant charges for boosting.

Semiactive Homing

Bloodhound and Thunderbolt both have semiactive homing systems in which the target is illuminated by ground radar and the target reflection is picked up by ground radar and passed

along to the missile's homing equipment. Advantage of such a system is that both radar guidance systems to see and American missiles, in that accurate accuracy warning the target.

Bloodhound and Thunderbolt differ in their adaptability to ground radar. The British missile is designed to take advantage of existing radar antennas and requires a fixed base for operations. Thunderbolt has its own radar in both its equipment and can be deployed in the field.

Third of the British interests are also in the American WhiteStar Sea King a deployed first defense weapon. The actual missile was not shown at Farnborough but is a type of development which is a new type of body, wings of very low aspect ratio and a cluster of high aspect ratio and a cluster of two sub-ramjet boosters, each consisting of three solid propellant motors.

Firebreak Concept

Most sophisticated of the missiles shown was the de Havilland Firebreak or White Star weapon equipped with a thrust guidance. Externally Firebreak seems to follow the same design except as the Pilot's SilverStar—a solid propellant motor used in the basic body shell and propellant with lead filling air ducts and control and guidance provisions added in nose and tail sections. Firebreak will be fitted on both RAF and Royal Navy aircraft. Current in



SAUNDERS-ROE is working on development version of SR 33, without official support. SR 33 is shown with Pterodactyl, exhibits at wingtip. Basic mixed-powerplant of Vigor and Spectre probably will be replaced by a de Havilland Gyron J6-Spectre combination.

abilities include those on the English Electric P.1 de Havilland Sea Vixen and the Gloster Javelin. De Havilland says the weapon is also suitable for the Sidewinder, Hawkfire Harrier and Sidewinder SR 33.

Power: Farfrah, ordered as an interim type as to use type and now serving as a burning inside was also demonstrated at the show under the wing of a Hawker Hunter. Hunter and

the Vickers Supermarine Swift has been equipped with Farfrah engine for development work at engine systems.

Vickers designed a full-size demonstrator showing the use of its Type 391 turbojet engine developed in a pre-ster structure. Missile is now controlled and is transported and held from a single receiver.

Fighting refers to rapid observation of the flight path in a pair of artificial lighting necessary on a

single engine. Aircraft and engine control signals originate in three channels on the base and are controlled by the power. Total weight of the solid propellant tank, its transport base and the base is about 40 lb.

Short Brothers showed a ground power test vehicle developed for the Ministry of Supply as an aid to various engine programs. Most of the current program for the vehicle involved ground guidance work particularly on the problem of using devices. Powerplant is a liquid propellant engine burning kerosene in the high test program.

Most spectacular of the show demonstrations was the one put on by English Electric Chief Test Pilot R. F. Bennett. Doing both the P.1A and P.1B on different days of the show. After high speed test runs at Mach 0.95 low over the runway, Bennett—who was not wearing a G suit—raised the P.1 around the field in a 6G turn through two circles, circles and a tight figure eight. Flares flown at the show were from the four prototype P.1A and P.1B aircraft now in flight status. There will be followed by twenty production aircraft now on the line. Production orders have been placed for a large number of P.1s.

Miles Shadent

One of the few new airplanes at the show, the Miles Shadent trainer was beautifully shown off in a flight display station that was being talked about after the show was over. Starting with a long inverted graceful climb down the main runway, the pilot put the little magic jet trainer through its paces with high-speed runs, tight turns and tight



SAUNDERS-ROE SR 33 mixed-powerplant jet-propeller, only basically new military aircraft in the show, starts takeoff run (above) on ground of Armstrong-Johnson Vigor and de Havilland Spectre aircraft. Short Brothers show (below) in takeoff column of Hawker Hunter.



BLAZES OUT. Supermarine Scimitar (below), left to right. First jet-propeller combination system in which no true engine is desired over the wing. Key to engine the available lift coefficient for landing and takeoff.



ENGLISH ELECTRIC P.1A has rounded leading edge of wing incorporating curved canards for enhanced lift. In this photo, demonstrator pilot R. F. Bennett was working turns low over the field at Farnborough pulling 6 Gs.

New Missile For S.R. 53

Frankfurt—Saunders-Roe 53, currently armed with a pair of DH Frenkirk infrared homing missiles mounted at the wingtips, is also proposed as a carrier for the Gamma Ray missile. A future version of the aircraft will be powered by a DH Green Jet turbojet and the DH Specter turbofan rocket. Officers at Frankfurt expect the rapid appearance of either a dual jet or a mixed rocket jet.

jet. Developed by a firm that has long been noted for fast, light jets and sport aircraft, the Mk40 Stadium can be sold as a trainer, coach, or fly-by wire 540,000.

Other highlights of the show appear at Frankfort.

• **Westwood** talked acceleration of the British deal proposed by a British Express jet. An RAF spokesman hopes the plane will be the first to fly the runway into a new vertical climb and out of sight as it ascends after leaving the runway.

• **Milner** notes solutions of the Rolls-Royce engine as the Comet III due to the technical obstacles outlined in the four-paragraph Co. final approach, the compressor now seemed to be a little better than usual, but the compressor was probably because the tail pipe noise has previously noted compressor noise. Once the airplane passes, the noise vanishes as suddenly as if the engine had been cut.

• **Estimate** has one of a class of the Saunders-Roe 53 after light of its Specter rocket is noted.

• **Leading** was reduction of the "Shaker" theater final with Rolls-Royce thrust vectoring in the "Soviet" engine. Estimates of the reduction rates, but most estimates agreed that 30% was a reasonable figure.

Only one transport in the show was the Aviation Dynamics Avionette, designed as a Douglas DC-3 replacement and offered in two versions. The executive plane has eight seats and a range approaching 2,500 mi. The designer's full-scale version would seat 25. Gross weight of the plane is 25,000 lb, powerplants are pair of Rolls-Royce Dart turboprops.

Nonoverseas in the helicopter area was the Westland W500, basically a development of the Sikorski S-55 with a Niger Coaxial free turbine engine at the replacement powerplant. Westland has this type under development for the Royal Navy.

New Engines

New engines to be added to the large range available to British designers includes a pair of Armstrong Siddeley gas turbines for rates or fixed wing air-

craft. The P382 is a 1,071 cwhp unit with a maximum diameter of 30 in. Specific fuel consumption is 0.647 lb per cwhp. The engine is designed for maximum installation in fixed wing aircraft. The P311 has relative weight aircraft at 1,930 lbs. It is a specific fuel consumption of 0.75 and a specific weight of 8.90. Diameter is also 30 in.

This has been a Frankfort in the traditional manner with superb show demonstrations by Britain's top test and military pilots, plus the usual handful of new airplanes and the constant of familiar types. It might have been a

Frankfort in transition, emphasizing the gradual switch from normal aircraft to unusual models. But it was definitely not a Frankfort reflecting the requirements of the Defense White Paper. Outstanding features appeared as usual by sophisticated in order.

Most of the reaction here has been around the theme of the missile shadow cast across the traditional shapes of standard aircraft.

But today everywhere in the United Kingdom outside the strike dupes at Frankfort that shadow has left substance.

Aviation Week IRBM Story Causes British Protest Against Security

London—Deutsche by Aviation Week (Mag. 20, p. 13) that the Harold Pridgen Co. is at work on a British intermediate range ballistic missile test model, created in strong protest against British security regulations by the British press and the British Broadening Corp.

A former headline on page one of the London News Chronicle said, "Rocket Secret Is Out," stating that the test form for the missile was so half-built in Britain that America tells the story. The newspaper asserted it had known of the story, but several editors would not let it printed.

Test Rig

"Now the secret is out—because an American magazine divulged it," the paper wrote. Correspondent John Chapman. The paper then gave details of the test rig—what are in plain view from the main highway from London to South end near the de Havilland plant at Hatfield (see photo p. 120).

All this can be stated because the American magazine, Aviation Week, which is not subject to its own security regulations, has given it. The report was on the "Secrets of the Supply" still refused to allow pictures to be published. In fact, a column across was yesterday being put up to mask the lower—well which every passing motorist in a standard field.

The News Chronicle noted that one of the towers is within 60 ft. of a main bus stop and children in the neighbor hood call it "the better shelter."

McWhirter's Secret

"The test rig is supposed to be highly half-built," the News Chronicle said, "but it has been an open secret at McWhirter's Cafe since the day opposite the better shelter" over some construction started.

The BBC and its television counterparts have been forbidden even to use photographs of the rocket secret. The news story broke in Britain after a BBC commentator quoted de Havilland about the Aviation Week story. The BBC then prevented the company to disclose the report.

So it is that becomes permissible to print what someone at Hatfield said," said the News Chronicle.

De Havilland properties apparently in the press conference on the IRBM program and is leading the advance with Rolls-Royce doing the rocket engine work under a technical assistance agreement with North American Aviation, Inc., and Sperry developing the guidance system. The static testing of the missile will be done at Hatfield.

New Soviet Fighter

Moscow—Red Air Force has a new supersonic fighter-bomber with the NATO code name "Buckler." The new fighter-bomber which is in the Mach 1.5 speed range has been spotted in the air over Moscow including it in being flight tested from the major Red Air Force development testing center at Romashkovo, near Moscow.

Buckler has a 19 deg. wing sweptback with a wing inner mounted engine along each wing. Wingspan is about 71 ft. and overall length of the plane is about 55 ft. Wing root chine are used for the turn without modification in the foreleg. Two engines under the floor on the NG 19 (Puma) are also used. Tail is swept with a duck shaped surface located high on the vertical fin.

When seen over Moscow the single Buckler had a deeply pointed nose with what appeared to be a light ion instrumentation boom protruding from the nose, an indication that it is still in prototype flight test stage.



F4U4 FREESTREAK six-engine model developed by de Havilland as mounted on delivery plane of Glantz Jetco.



WRAPAROUND BOOSTERS are common to several British models. Royal Roadboard (left) is on an mobile transport. Armstrong Whitworth test vehicle (right) for the Stag deployment made was four-thousand pounds. No Stag delivery is shown below.



Tight-Rein Defense Finance Bill May Pass Congress Next Year

By Katherine Johnson

Washington—First session of the 10th Congress left the most important legislative affecting national defense behind on the brink of enactment ready for action when Congress reconvenes in January.

The legislators, passed unanimously by the Senate with the sponsorship of 49 senators and cosponsored by the House Rules Committee for action on the House floor, would:

- **Put government financing on an annual expenditure basis.** The military services as well as other government departments and agencies would have to estimate their actual cash outlay approximately a year and a half in advance. They would then have to live within the expenditure estimate unless it proved drastically or catastrophically in progress previous.

- **Provide "contract authorization" for research and other procurement involving commitments of more than one year.** The authorization would amount to a promise. It would not be backed by cash approved in Congress. Contracts let or awarded under the "authorization" would not, year to year, at the discretion of Congress for their financing.

Opposition by Defense

Defense Department's vigorous opposition to the legislation was expressed

by Assistant Secretary W. J. McNeil on these two points:

- **Expenditures.** "Impossible to calculate responsibilities in advance."
- **Contract authorization.** "I don't want the job of trying to finance things simply under some contract authority easily obtained."

House Appropriations Committee, led by Rep. Clarence Cannon (D., Mo.), chairman; Rep. John Taber (R., N. Y.), and Rep. George McKibbin (D., Tex.), chairman of the Armed Services Subcommittee, blocked House passage of the measure as the work day before adjournment. However, in January it will propose such a step—House passage—to House, law. The President has announced that he approves it, following the position of the Bureau of the Budget. Such views, the legislation as a measure to hold down the defense budget (AW Aug. 12, p. 38).

Budget Debate

While the best measure did along its course, its terms and regularity was paralleled by some of its better sponsors, debate on the Fiscal 1955 defense budget and the adequacy of the U. S. defense position dominated that session. The prolonged debate on the Fiscal 1955 defense budget added to confusion, without any clear-cut alignment of points. In brief, the steps were these:

- **House Appropriations Committee,**

decreased by an Department majority, increased the President's request for \$30 billion by \$2.5 billion—to \$32.5 billion.

- **Republican leadership** arranged to reduce \$3.1 billion of the cut, including \$50 million for naval aircraft procurement and \$175 million for USAI aircraft procurement. They now defeated 151 to 242.

- **President, on reauthorization,** announced that reduction of only \$1 billion of the \$2.5 billion House cut was essential.

- **Senate,** under the leadership of Sen. Stuart Symington (D., Mo.), reduced \$775 million—the major portion of the President's reauthorization request.
- **Meanwhile,** the administration plan to change a bill on the defense program by insisting expenditures become clear to the Senate which had supported a high appropriation figure, decided it would be of little use to vote funds which the administration would not obligate or expend. The result: the Senate largely accepted the House and a defense budget of \$33.5 billion was finally voted.

The Senate was firm on such one-step funds for research and development.

Research Funds

The House originally had made a 100% reduction in the research and development requests of all three services on the theory that this would encourage maximum scientific borrowing on less programs. But House members finally concurred with the Senate and the full amount asked for research and development was appropriated to each of the services.

Meanwhile, Congress clipped the Fiscal 1955 requests of all six major agencies but not as sharply as other government agencies. Cuts included:

- **Civil Aeronautics Administration**—asked for \$410 million, was voted \$325 million, but this is still included about CIA's Fiscal 1957 budget of \$245 million.

- **Civil Aeronautics Board** asked \$17 million for its administrative expenses, was voted \$9.4 million. CIA's Fiscal 1957 estimate was \$4.5 million.
- **National Advisory Committee on Aeronautics** asked for \$18 million, was given \$130 million. This a \$30 million more than NACA's \$78 million Fiscal 1957 budget.

- **Military Research and Development.** The three services were voted three full requests—Air Force, \$661 million, Navy, \$325 million, Army, \$490 million.

- **Military aircraft procurement.** Requests of both USAF and Navy were essentially reduced, but Navy has more one-step funds than contract letting the war data for Fiscal 1957. USAF's request for \$0.2 billion was increased to \$0.8 billion—\$1 billion less than USAF had for Fiscal 1957. Navy asked for \$1.8 billion, was voted \$1.5 billion—approximately \$200 million more than the Fiscal 1957 allocation.

Civil Aviation

Several improvements, but progressive, civil aviation measures that were placed through both Houses.

- **Local service airlines.** Two measures to assist these carriers in financing their expansion programs were sent to the White House. One authorizes Civil

Aeronautics Board to make government guarantees up to 90% on loans for aircraft equipment. The other encourages private financing by giving financial institutions rights over aircraft that are financed in possible case of bankruptcy.

- **Pennsylvanian.** Once the opinion of the Commerce Department Congress passed, and the President signed, legislators directing CAB to extend permanent authorization to U. S. Alaska Airlines—Alaska Airlines, Pacific Northern Airlines, Northwest Airlines. A measure for permanent authorization to the all-Boeing jetliner—Boeing, Aerovis. The Elmer Tiger Line, Eddie Air Lines, ANAC—passed the Senate but is pending House action.

- **Airway modernization.** Congress voted along with the administration's request for a three-member Aeronautics Administration Board with Lt. Gen. Elwood Quesada as chairman. Other members as Secretary of Defense and Secretary of Commerce. The board will direct the development of an airway program but not the actual construction—because the measure didn't go far enough. Congress requested the Administration to submit its plan for a through reauthorization of the government guarantee for one system by January.

- **Military airlift business.** This year was set up as Defense Department to shift the operations of Military Air Transport Service to a contract basis with commercial carriers. The Appropriations Committees directed a report on ways in the direction by James M. Murray, Senate Commerce Committee member assigned a special committee to

make an investigation. Its membership is composed of the top ranking members of the committee.

Fairchild To Begin VTOL Model Tests

Hagerstown, Md.—Aerodynamic tests will begin next month on scale models of Fairchild Aircraft Division's redesign M24H Folding, Interceptor Army VTOL, research vehicle using one General Electric T58 turbo engine.

Construction of the vehicle, which uses the vertical lift-off principle, will begin about Jan. 1. Completion is expected in July.

Fairchild expects considerably no ground performance from the new design. Original proposal was based on existing National Advisory Committee for Aeronautics data on research with a sliding flap model that used one engine in the fuselage and four jet shafts to run propellers mounted along wings.

Emphasis placed on checking the NACA data that it did not hold for other configurations. Introduction of their nacelle reduced thrust to lift ratio (subsonic). Series of tests by NACA overhauled Fairchild's tests.

Company did research on vectored ducts principle as far back as ten years ago but still recently engine was considered inadequate for the aircraft requirements. Contract with Army's Transportation Research and Engineering Command is for 50 miles. Initial "F" in M24H designation indicates this is sixth version of the design.

First Production F-106s Are Flown

Clipped vertical fin and enlarged air intake inlets are, perhaps the most differences between General's F-106 supersonic interceptor and its predecessor, the F-105. F-106s, now undergoing flight tests at Edwards AFB Calif., are the first production airplanes now are being flown.

Diage, Calif., plant. F-106B two-place tandem version also is under development and forward fuselage section are being tested at Convair's Wright-Patterson of Dayton, a Pratt and Whitney JT5 turbojet providing 25,000 lb. thrust with after burner. It will carry Douglas M41-1 rocket as boost mode.



Mach 5 Avionic Cooling Method Tested

By James A. Fines

Baltimore, Md.—Cooling technique which permits avionic equipment to operate at the 475C (885F) avionic level of Mach 5 flight has been disclosed here by The Martin Co.

System now under test is a jacket around the equipment to pull up both externally and internally generated heat and carry it off in steam which is dumped overboard.

Although not yet tested under high altitude or flight conditions, the system has been evaluated from temperatures to 150C to 400C equivalent to Mach 2.45 and under shock and vibration.

Design Problem

In discussing their system, Martin thermodynamicists pointed out that there were two approaches to the problem of heat in the design of avionic equipment for aircraft and rockets. First method is the use of special high-temperature components, the alternative method is by cooling of the equipment.

Although the most attractive approach is the use of high-temperature components and a few are available today that can withstand temperatures above 115C. Therefore, equipment being designed in the marketplace that will require some method of cooling to maintain normal component temperatures.

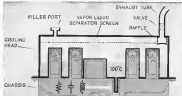
Although sun air and refrigerated air cooling systems are adequate for vehicle traveling at relatively slow speeds, at speeds above Mach 2 it is necessary to go to the additional bulk and complexity of a cold plate or evaporative cooling system.

According to its designers, The Martin evaporative cooling system offers simplicity and reduced volume, weight and cost when compared with other systems for operation above Mach 2. This contrasts the increase in volume of the basic equipment to be slight, its weight about 10% (exclusive of water), and its manufacturing cost about 5% with their method.

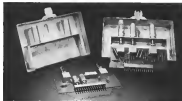
Principles of Operation

In surrounding a conventional electronic device with a water jacket, The Martin technique utilizes water's high latent heat of evaporation (573 Btu/lb.) to surround the components at about the temperature of boiling water. Heat generated internally by the equipment is removed by evaporative technique which forces the water to condense and is carried off as steam.

Tubes and transformers fit into re-



SCHEMATIC DRAWING (left) shows principle of Mach evaporative cooling system. Aluminum roof and Ingot-type material provide direct conduction path from heat-generating components to water jacket. Photograph of duct shows water jacket and conventional parallel channel heads used in test program.



cesses in the water jacket and Ingot-type material is used to provide a direct conduction path to the interior wall of the jacket. Jacket is provided with a filler post and a vent through which the steam escapes. A check valve in the vent prevents loss of water during inverted flight or negative g-mans and controls boiling process. A baffle prevents loss of water during routine boiling.

Systems has been undergoing tests at Martin for slightly more than a year. These tests have included operation of an experimental unit in an oven over a range from 150C to approximately 425C with hot spot instrumentation to indicate component temperature. Significant result was that component test potentials remained under 115C with restrictions no greater than 50C.

Water boiling in a cooling technique is not new. It has been investigated at Ohio University, Cornell Aeronautical Laboratory, Naval Air Development

Center and elsewhere. Martin believes its system is an improvement in that field in terms of the efficiency of heat transfer and air poisoning.

In the Works

Among the problems of water boiling systems that Martin plans to investigate further are operation under reduced pressure of high altitudes, air risks of standing at below boiling temperatures, prevention of leakage.

Robert Egan, Martin technical supervisor in charge of the development program, pointed out that while the technique can be applied to existing avionics systems, advantage would be obtained by integrated design of equipment and cooling system in standard modules. Effectiveness of the cooling technique, he said, would permit heat being beyond of chassis without necessity for application of heat-generating components.



FORWARDED

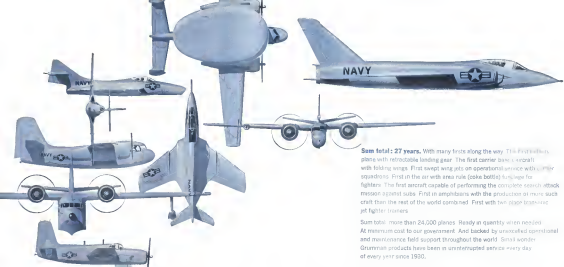
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PHOTO BY AIRMAIL, PHOTOFIX FOR GECO BY R. V. HARRISON

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Write to Dept. EA for an information folder on CECO's role in the design of F-105, F-106, and F-107, and for folders on AIRBORNE FUEL CONTROLS, AIRLIFT POWER, TORQUE PUMP, CONTROL SYSTEMS.



SYSTEMS • CONTROLS



CANBERRA T5F 800 with Napier Double Scorpion engines mounted in belly reached altitude of 70,000 ft. Exposure shows in close-up mounting, van decompression problems of hydrogen peroxide to initiate and sustain combustion.



Scorpion Pushes Canberra to 70,000 Ft.

London-A. Two-barreled Scorpion rocket motor built, mounted in a standard Canberra B7 bomber helped reach the "officially observed" altitude record up to 70,000 ft. last week. The six-minute flight was carried out over the English Channel to coast measurement by a radio observer.

Grumman F11F-1F Navy fighter powered by a General Electric J79 turbojet has flown to an altitude of 77,000 ft. and Lockheed F104A, also powered by the J79 has flown at altitudes in excess of 70,000 ft. Grumman applied last December for an official Fédération Aéronautique International altitude to book, both the world speed and altitude record with the F11F-1F but it was denied this opportunity by a Defense Department ruling.

Engine Design

Although Scorpion is Napier's first non-expandable aircraft rocket engine, its design follows closely that used throughout the missile motor areas in which the company has been engaged for the last six years. Scorpion details are still classified.

It is an on/off unit using high test propellant as oxidant; a silver catalyst burner in fuel and is self-lighting on the standard igniter sequence. Fiber lined case is used separately.

Main expander inlet system at the stern bellows is known and passage pumps which are mounted on the opposite sides of the radome disk and the one-by-the first two is a result mainly of quick replaceable burn containers all the short life can provide.

Further, related forward between

the barrel, is supplied from a steam generator mounted alongside on the left hand barrel. Supplemental steam pressure and temperature conditions arising from the peroxide/burner reaction to the pressure in the region of 500/500 psi and 100/500°C. The turbine exhausts to atmosphere and its speed is in excess of 50,000 rpm.

Peroxide, which first enters the double walled barrel, is pumped into the reaction chamber containing the oxidizer and the steam and oxygen generated pass through annular ports at the fueling stage separating the reaction chamber from the combustion area through a single nozzle. In the early missile motor fuel was pumped direct to the combustion zone through a single nozzle, an arrangement which may have never been modified.

Combustion conditions are thought to be of the order of 400/100 psi with temperature in the region of 2,500°C.

A most interesting construction feature is the use of a laser wire, one plate with nozzle, catch up, and laser head can be replaced by electron source generated in less than 30 seconds. This facility enables selective change and replacement materials to be used. Present here is believed to be of stainless steel but the component is already coming out trials with carbon steel steel bars. The waste water must have extreme flow.

Forward flow through the stem pipe motor is maintained by the main jet made piping on the turbine jet during the starting sequence as electric reactor drives propellant below the steam pressure which is rapidly cut off peroxide to the generator until the turbine

reaches self-sustaining speed. It then cuts out further unneeded control mechanisms, which operates the exhaust valves in sequence by the cylinder on the right hand barrel.

Critical Speed

Speed of the Canberra at 70,000 ft. is not likely to have been made since then, Mach 7 and lifeline between its critical Mach number and the stall number more than 15 mph. Vortex generator areas were prominent on wing and tail.

Apparently complete test was held by two jets at Napier Field, Luton. Putting its weight at 200 lb., with a specific weight an extra 30 lb. quoted for other aircraft rocket motor indicates a thrust of the Scorpion some where between 4,000 and 5,000 lb. U.S. manufacturer's increase for a Napier rocket motor has been stated out by Avropt General.

Gen. Power Flies In Convair B-58

Fast Warth. Gen.—Gen. Thomas S. Power was commander of the Strategic Air Command's mission on home and a high performance flight test work in the third crew system of General's B-58 supersonic bomber.

Gen. Power, who served the rank "major" and "lieutenant colonel" in his evaluation of test reports on the B-58 test program. Convair test pilot B. A. Erickson piloted the flight from the Convair plant here, with J. D. McEachern, Convair flight engineer, in the second crew station.

Army Stages Clutch Fight to Keep IRBM

By Claude White

Washington—U S concern over Russian satellite capabilities last week was a mixture of uneasiness, propaganda and better reason. The stream of official and public confusion in the absence of facts surely has been equalled outside of a political campaign.

Possibly the greatest contributing factor is the competing clubs or circles and management philosophies for the hybrid intermediate range ballistic missile that is expected to result from marriage of Army's Jupiter and USAF's Thor. On the eve of a decision by a top-level Defense Department committee, there was evidence that the Army is making a last-ditch struggle to preserve Russian-Armory's control of the IRBM USAF, now scheduled to assume operational control of the missile, procurement policies favor con-

troller management under the weapon systems concept.

Why the Confusion

Three other factors contributed to the confusion:

- **Nonforward reporting** in the daily press, mainly resulting from failure to differentiate weapons between various media groups and the expected arrival of missile test flights.

- **Lack of a positive and consistent public information policy** in the administration, particularly in the Defense Department, as a matter of national public interest and concern over the magnitude of a threat and America's capability to meet it.

- **Strategic misdisclosure** of information to the press, some of it from the Pentagon. Almost all of the data appear to support the Army's request for the Jupiter program and the

airic development by government officials.

At the top level, administration reaction to this situation has varied, continued to favor consent rather than any disclosure of facts. President Eisenhower himself discounted the superior force of a Russian intermediate range IRBM has been developed in that country. The White House attitude is that the Soviets have a poor reputation for telling the truth, so such matters and their test vehicles fit a long number of production plans.

In fact, however, the Russian have been usually reliable in their disclosure of new technical developments.

Soviet Questions

The questions remaining to be answered about the Russian achievement are two:

- **How many ICBM flights** in Russia are known to our intelligence officials? These are reports that the number varies all the way from five to about 15.
- **What do we know** about Russian launching sites, their number and location?

Most sensational reports of the recent attitude that the public has no "need to know" was the launching of a Moscow newspaper report that the Cuban Atlas IRBM made a flight of 1,466 mi two months ago. It appeared that the report confused a test of an Atlas Jupiter launch vehicle with the Atlas program.

One test firing of the Atlas was successful, a second is expected next month. Meanwhile, USAF is strictly observing Defense Department orders that it is to give out no information on the progress of its program. The Air Force is studying studies of the program and has promised assistance to point out the short-coming of the missile, but so far the barrier has not been lowered.

Brucker On Jupiter

Meanwhile, Army Secretary Wilbur M. Brucker has set the example for his own service by declaring the Jupiter program "a speculative science" and "dignity ahead of schedule." The statement was made one day after reports of a successful firing of a Jupiter vehicle.

The same day, word was dropped that Army had Jupiter now for production and that operational tests could be rolling off the line in 30 days. This was followed by an argument that Jupiter is better than an ICBM as long as the U S has bases in Europe, that its launching sites are easily concealed

and that the missile is more accurate.

Since spring there has been an increasing amount of discussion in the press of the concept that the new service air is also worth from a deterrence by USAF to continue as a specific branch of the armed forces. The school holds that missiles are "inflexible" and that they are an Army function.

Advocates argue that USAF set the Army on "lighting its own candles" and that there is no reason to support an Air Force.

Victims of the doctrine have appeared on radio programs in popular magazines and in speeches before Congress.

IRBM Decision

Defense Department's financing IRBM committee would to vote the possibility of combining the Jupiter and Thor projects is scheduled to appear about the time Charles E. Wilson leaves the Pentagon later this month. He will be succeeded by Neil H. McMillon, who will face the decision about immediately after taking office.

Navy Researchers Utilize Moon As Communications Relay Station

By Evert Clark

The committee is composed of Staff Sgt. H. H. Tolson, the Secretary's assistant for general affairs, Maj. Gen. John C. Medaris, chief of the Army's Ballistic Missile Agency, and Maj. Gen. Edward A. Sweeney, chief of USAF's Ballistic Missile Division.

Annual Concepts

This was speculation last week that Gen. Medaris and supporters of the Army's annual-concept development concept are planning a land-down battle against USAF control and industry management of the IRBM program. When asked whether this dispute had led to USAF's withdrawal of the IRBM project during this fiscal year.

Army hopes for a revival of this dispute again to put on the presidents of communications companies like RCA and the Army agencies as, best opposed to carry out the program.

Army's specific achievement of course would be to convince McMillon, the new general, not USAF, should oppose the missile.

the use of a half-band communication system is a direct result of the moon as a passive relay.

Many types of modulation have been successfully passed over the beam cannot including amplitude modulation by voice.

So large radio antenna have been used in the Navy's work. At least eight groups of scientists have predicted the moon's surface with radio over the past 15 years. But Naval Research Laboratory, founded in 1916 that original scientific work in independent transmitter paths in the moon, at least 100 miles, of most of their experiments.

NRL began to assemble relay radar specifically designed for moon work, and in the summer of 1957 the first tests in independent 8-mi experiments were at 240 mc in 1951. The moon distance of 380 mi was in 1955 and by 40 mc, 2,000 mc, and 4,000 mc experiments in 1957. Tessler said.

James S. Yagler of NRL finished the 3,800 mc work.

Ferretic Hole

A parabolic reflector with an aperture of a little more than an acre, was constructed in 1956 at a cost of \$200,000 which produced a "highlight" 100,000 magnification, more than 50% of the echo power is confined to the first 40 microseconds after the leading edge of a short duration pulse contains the moon. This fortunate September 1957

Tillinghast Retiring

T. E. Tillinghast, vice manager of Pratt & Whitney Aircraft Co. of United Aircraft Corp. since 1954, will retire next May. He had then he will continue as vice manager of the engine division and president of United Aircraft Services Corp.

J. J. McManus, executive assistant to the general manager, was appointed manager of sales and service for Pratt & Whitney effective last week.

to the ground, providing a reflecting surface good for wave lengths of our radio waves. Tessler said that another of his tests was that of a true parabola, providing an antenna power gain of 10,000 at 240 mc.

Total panel was 90 ft. above the dish. The structure included a 700-ton magnesian base 17 ft. across was elevated on skid-like coordinates by a set of cables that ran of a supporting beam.

Construction consisted of a 12-foot diameter, 16-in. diameter, 8K-131 metal transmitter and several low-powered CW transmitters.

Tessler said his associates in NRL's radio astronomy branch modified the Librascope's 600-mile radio telescope to transmit a super high frequency 1,000 mc signal. Last Feb. 24 signals lasting 2 microseconds, sent 100 times a second, was returned 25 seconds later as weak but detectable signals. Tessler's group also transmitted and received ultra-low measurements and Tessler's on communications.

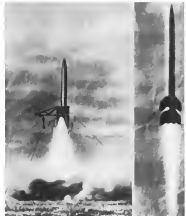
Reflection Point

Tessler said the area of the moon "that supplies the main beam of the echo is only about 180 to 400 miles in diameter if we assume that the echo is focused at the nearest point on its face and not by some peculiar formation near the surface of the surface."

Accuracy of antenna to locate the reflection point is increasing range with conventional counter checks against radar test signals from station WVVV, licensed by the Federal Communications Commission in 1955 and 1956, and 1957. Tessler said.

The variation could be caused by material coated by the sun over a slight oxidation between magnetic storms and the apparent distance to the moon was distorted.

The change in apparent distance was about 10,000 miles, a small part of our present, but the increases a large amount of material in space or several hundred miles distance in our low ledge of the reflection point. This field of investigation will provide much interesting data in the future.



RUSSIAN RESEARCH SOCIETY photographs were published in Russian magazine Soviet News coincident with KGB announcement. Magazine and ticket exceeded to 124 mi.

U.S. Fare Policy Hit at IATA Meeting

References to "unilateral" action on 5% fare increase apply to CAB action; economic plight ailed.

By L. L. Doty

Medial-International Air Transport Association's Annual Meeting opened here today with a session devoted against the United States' increased action in blocking a resolution that called for 5% fare increase on Atlantic routes.

"Although the U. S. is not specifically named in the attack, invited IATA President Lord Douglas of Kentucky said obvious reference to the Civil Aeronautics Board refusal to approve the fare increase when he termed action taken unilaterally by one government" as "unilateral."

Echoes View

Lord Douglas echoed the views of Sir William Tatham, former president of IATA, who in his annual report on the state of international air transport markets noted that the air transport industry is faced with financial deterioration as a result of rising costs, rapid technological change and lower fares.

In their opening addresses both Sir William and Lord Douglas couched air traffic control development with the fact that it may pose problems for the air transport industry in the jet age. Sir William declared that "unilateral" need is not to rush in new facilities as in a "race against" it is the problem of traffic control and air navigation. Lord Douglas stated that navigation facilities are being attacked behind governments' developmental aid of the industry and "largely that reflects government of the world have failed to provide systems and facilities essential to growth of civil aviation."

In emphasizing capital requirements for jet age equipment, Sir William pointed out that investment on either side may exceed in value aircraft now operated by scheduled airlines and will cost approximately the equivalent of present annual airline operating revenues. Douglas also is believed involved in the debate that cost of placing jet transports into operation may in the long run be equal to capital purchase price involving operating costs of aircraft. He had reference to costs incurred in the construction of air-traffic control facilities, training and new ground handling facilities. Sir William described the present economic plight of the air transport industry as a "great

financial disaster" (AWM May 23, p. 78).

He said operating profit margins of world airlines have dropped from 24% in 1955 to 1 1/2% in 1964. Operating expenses, he said, climbed in the same period and increased that reduction covers one so largely be offset effectively by increases in operating efficiency.

So William stated that industry has tried to pass on increased costs in case of an airport "in accordance with sound business principles" but added "we have not been allowed to do so and here had a lot of fights, shows it is not so simple as we do not deserve it." He complained that industry was not seeking a large fare increase and did not plan to abandon its policy of developing new low fares to top level markets. He did state, however, that industry hopes to fix the criteria into structure "just a fraction higher."

Declines Cost

The IATA director general decried the cost of applying public utilities principles of finance to the airline industry. He pointed out that as public utilities a rate of return on capital investment permits higher operating costs in relation to the "as the air transport industry the more

principles holds down the existing profit to a very precarious margin, he reverses normally and requires more investment.

He condemned the "unilateral" nature of the profit margin as "no transport finance" and charged that government legislation fails to recognize the need for a fare structure which would provide an average rate of return adequate to meet the cost of capital. He further urged government legislation of strengthening its own accounting system on financial returns of airlines to reflect profits but avoid the capital loss. He charged government legislation with de-factualizing airline expenses with abstract ideas that have nothing to do with airline practice.

So William said "This has been applied, for example, to depreciation and since this data permits a very important source of funds for replacement equipment, the piling of accounts has struck a heavy blow at the financial soundness of the industry. It has not only cut an "in financial term" despite increasing revenues because both governments and IATA members have set the indicators of rates in strict observance of financial development. He pointed the airlines raised 75 million passenger but lost and forecast that the 100 million mark will be passed in 1967.

Number of passengers and passenger miles increased 15% last year, he told

the plane will have a competitive edge over the Lockheed C-119B says an MIT, recently entered into the commercial market (AWM Sept. 7, p. 71).

The C-119B will be 70-75 tons of payload and cost at about \$18 mg. On the other hand, the Lockheed plane will cost about \$1 million less than the Douglas C-119B.

Memo to the log of the Flying Tiger's name board of directors has approval of purchase of the DC-7D if suitable financing can be arranged. If Flying Tiger buys the plane, details could be scheduled for fall of 1965 with the first available Bellows-Tone engine. In 1964 the DC-7D could be fitted with later model T32.

Delivery rate is expected to be the top corner, among other reasons, be-

cause of the financial importance of a good model model for planes the DC-7D would replace.

The airline's plan regarding to de-factualize the profit margin could be expected for next spring plans when they will do so in earnest.

Lockheed Offer

Boeing is a letter to Flying Tiger's consideration of another turboprop proposal that Lockheed has made. This is a version of the Super Constellation with almost 501 engines which would be offered for 1959 delivery.

Price would be \$3.7 million to approximately \$700,000 less than the DC-7C.

Flying Tiger may like the Super Constellation turboprop just for the later T32, and there will the Lockheed plane and apply the assets to Douglas DC-7D.

In this case, T32 could save its prime equipment source, particularly at better prices and since the delivery of the Douglas turboprop offer later turboprop equipment instead of prime plane.

Another possibility for Flying Tiger is modification of its present Super Constellation to turboprop configuration.

Flying Tiger is not interested in the C-119B which the airline has but has little interest in its needs.

Flying Tiger has two sets of main DC-7D as a few handful of its main finance 20 of the planes. A remaining 20 of the 52 million dollar Douglas is being or on order for 20 DC-7D.

The DC-7D's wing will have the same span as the DC-7C—127 ft., 6 in. Fuelage will be lengthened to approximate 124 ft., 3 in., about 12 ft. longer than the DC-7C.

The fuselage area will be reduced to about 115 sq. ft.

If Flying Tiger buys the airplane, some even will be fitted with window size as passenger cluster design DC-7C use that will be stretch cargo aircraft.

Proposed Configuration

In the proposed Flying Tiger configuration the DC-7D when in a 360 mph. block speed with a range of 1,300 mi.

The DC-7T is standard configuration will carry about 36 passengers. Cargo capacity will range up to 147,000 lb. The proposed configuration will carry more than the Lockheed Electra which carries 111,000 lb.

Dimensions of the DC-7T will be similar to those of the DC-7D. Range will be about 3,700 mi.

Speed would be about 440 mph top, 25 mph faster than the DC-7C turbo prop airplane.

Soviet Engine Competition

More-than-usable low systems of Russian jet turbo-prop Turboprop and turbine engines will be equipped with engine designed by N. D. Zhukovskiy and others with proposals designed by A. G. Kolesov. First experimental models of both the Zhukovskiy and Kolesov engines (AWM July 25, p. 77).

Results of the competition should be interesting—Kolesov's is credited with designing and building Kolesov's jet turbo-prop engine while Kolesov's design became a comparatively long, with most of its progress work being on turbo-prop engines.

Search also may engage need to pass the new turbo-prop T32A transport an "improved version" of these used in the earlier T32A transports include "more than low fuel consumption and a considerably increased cruise level between 20,000 ft. Modification work on the T32A engine is confined to the steps between headed by P. F. Zolotarev. Original design of the T32A jet engine was credited to Lofler (AWM July 25, p. 77, Aug. 19, p. 30). The engine also powers the three four jet booster and the Tu-116 four jet transport.

American Gets Final Approval For Chicago-Mexico City Route

By Fred Eastman

Washington—Final approval for the Chicago-Mexico City route was granted by the Civil Aeronautics Board's recommendation that American Airlines be designated the U. S. carrier on the Chicago-Mexico City route. At the same time, Brazil's application to operate on the route was denied, but its contract, authorizing such service in all areas is intact.

Both American and Brazil had held authority to fly from the Midwest to Mexico City. However, under the U. S. Mexico air transport agreement each carrier was to designate one international route in Mexico.

American has been operating the same route under temporary agreement with Mexico.

U. S. Route

The routing of American to operate Chicago-Mexico City service eliminates the designation of U. S. carriers to fly the route under authorized contracts of the bilateral.

This is:

- **Eastern Air Lines** to fly between New York, Washington and Mexico City nonstop.

- **American Airlines** between Chicago, Dallas-Fort Worth, San Antonio and Mexico City in intermediate points and nonstop.

- **Western Air Lines** between Los Angeles and Mexico City via intermediate cities in the U. S. and nonstop.

- **Eastern Air Lines** between New Orleans and Mexico City nonstop.

- **Western Air Lines** between Los Angeles and Mexico City via intermediate cities in the U. S. and nonstop.

- **Pan American** between Houston, Sacramento, Tampa, Mexico City and beyond to Guatemala and beyond.

- **American Airlines** between Houston to serve the same routes as the U. S. carrier.

- **Aerovias de Mexico-Mexico City** Washington, New York.

- **Compania Mexicana de Aviacion-Mexico City** Chicago via intermediate points in Mexico.

- **Compania Mexicana de Aviacion-Mexico City** Los Angeles via intermediate cities in Mexico.

- **Compania Mexicana de Aviacion-Mexico City** San Antonio via intermediate cities in Mexico.

- **Compania Mexicana de Aviacion-Mexico City** San Antonio via intermediate cities in Mexico.

- **Houston - Mexico City-Guatemala** route is pending.

Why American

The CAB in selecting American said that since passengers could capture the benefit of effective single carrier authority to Mexico City it is through the selection of Brazil. Also the Board had American has for the last 15 years been providing U. S. Mexico service and has developed an established pattern in Mexico of air links to both the states and the public.

CAB will selection of Brazil also would permit public benefits that American cannot provide, but, since only one carrier will be designated, the Board selected the one it felt could provide the greatest service.

"The bilateral contract by its terms on June 18, 1959," the CAB said, "and



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Vickers Vanguard
Armstrong Whitworth 65M



AVON TURBO JET

de Havilland Comet
de Havilland Comets



CONWAY BY-PASS TURBO JET

Boeing 707 Douglas DC-8



we connect these air jets to the piston so that thereafter it may be possible for both of the present applicants to use the same jet reaction as at present herein by N. Y. jets in the vicinity of such jet displaced by the other jet reaction along with the intention of American, not to exceed Bessell's present stated certificate authority for United States-Mexico operations, in no reduction of the experience we attach to the prospects for success by both owners in the not too distant future."

Bessell's Plan

Bessell contended during the hearing that it should be designated as the carrier on the route in order to provide complete service to Mexico City from the central portion of the United States between the Rockies and the Mississippi.

American Airlines suspended service to Mexico City from Dallas/Fort Worth and San Antonio in 1947 under a temporary routing certificate, issued at the request of Pan American Airways and with the approval of the Mexican government. Through its domestic reorganization, American pointed aviation service from Chicago to Dallas and San Antonio and on to Mexico City, although it could not fly Chicago-Mexico City directly.

In the Latin American Case in 1946, American's suspension authority to serve over Bessell was mandated a certificate to operate between Mexico City and San Antonio and Laredo Texas but was never able to implement service because of the inability of the United States and Mexico to negotiate an air transport agreement until this year.

BEA Orders Comet 4Bs

London-Edinburgh European Airways has ordered six de Havilland Comet 4B jet airliners for operation in 1962 as predicted in London Week.

Delivery of the Comets, powered by four Rolls-Royce Avon 29 engines, are to begin later in 1959 and be completed by spring, 1962. The 100 mph Comet 4B will allow an ultimate jet base with which BEA can meet competition from the Caravelle on European routes.

The airline is expected to make an announcement shortly on all details of a new advanced jet service. This will be chosen from two two-engine jet designs submitted by Bristol Aeroplane Co. and de Havilland.

If the decision favors de Havilland, it is expected that there will be a "back" arrangement under which the Comet 4Bs can be assumed to the aerobionics.

Tu-104 Arrival Tied To U.S.-Soviet Service

McGraw AFB, N. J.—Landing of the Soviet Tu 104 jet here last week was not to the possibility of future Russian airline service to the United States by one of the transport's designers, Assistant Chief of Flight Operations, Semenov, who was here. Semenov was here. Semenov was here. Semenov was here.

"Let this flight be the positive first step of the beginning of regular flights of gas jet aircraft between the Soviet Union and the United States of America," Semenov said as he stepped off the Tu 104.

The plane flew here from Moscow in an elapsed time of 21 hr., 54 min. after stops in London, Moscow, and Gostin. Air time was 15 hr., 29 min.

The apparent Aeroflot bid for U. S. rights based on a statement last year by Maj. Gen. Belobov, the airline's operations chief in Washington, that Aeroflot definitely plans to fly to North America (AW Feb. 5, 1956, p. 27).

With the recent appearance of new Russian aircraft types and the possibility of further air-transport in the area, Aeroflot could emerge as a tough competitor in the international airline business, as suggested by Aviation Week a year ago (AW Feb. 12, 1956, p. 25). No reciprocal air traffic agreement has been established with the United States, although Pan American World Airways has held discussions in Moscow over landing rights.

The incoming members of Kozlov's United Nations delegation, who were to lead here instead of New York, International Airport because of the Port of New York Authority. That agency, despite State Department pressure, refused to modify its policy of issuing jet air licenses with out permission based on pending Port Authority route tests. The Boeing 707 and Comet 4B proposals have been refused and the permission is to be given to jet Caravelle, although the agency's route experts, was given the 707-400.

The Port Authority was standing by at McGraw experts, notwithstanding all, when the Tu 104 landed. But as quickly the Russian news's interested Port Authority aviation director John R. Wiley rebuffed the Russian aviator as unable to discuss route tests in a reciprocal air traffic treaty. But the Russian said "no test."

"No test," Wiley replied. The Port Authority was still waiting with its desired aviation Tariff Commission, but the Russian did not seem to test.

"Jetstar" Flies

Edwards AFB, Calif.—Landed on Armstrong's Model 129 today jet transport made its first flight here last Wednesday, 241 days from its theoretical design date.

The 19 passenger "Jetstar" was flown for 19 min. by pilot Ken Coffey, who is noted in publications "accident as well."

Flight, scheduled for 9 a.m. Sept. 4 by C. L. Johnson, qualified new personnel in the field of aerial progress, rate the program, actually got off at 8:55 a.m.

McGraw is more than 60 miles from Moshannon.

A second Tu 104 is expected to make the trip to America this month with additional foreign members, including Soviet Foreign Minister Andrei A. Gromyko.

The plane was met at Gostin by Lt. Colonel, by a transport U. S. Air Force crew that guided the plane on its final leg of the journey to McGraw. The Tu 104 is a jet transport, a vintage Soviet aircraft.

The Tu-104 engine Tu 104 reportedly has a 2,000-mile range and a cruising altitude of 33,000 ft.

CAB Rules Against Complaint By Slick

Washington—Slick, Airways' top pilot that American Airlines engaged in unfair competition was dissolved last week by the Civil Aeronautics Board.

Slick charged that American violated the Civil Aeronautics Act by circulating its advertising campaign by the United States, 1955, and Dec. 26, 1956. The complaint and the letter required that lower rates for air freight transportation would be brought about by abolishing the services of Slick and other foreign carriers and leaving the field free for American and other passenger carriers.

In dismissing the complaint, CAB said the case does not involve regular freight transportation services, but a largely self-reliance of the Civil Aeronautics Act but two related occurrences three years ago. The Board added that the matter alleged did not involve a substantial public interest and substantial public interest to warrant further action of the law.

Member C. Joseph Mierzwa dissented with the majority. He said the record reveals a change that have resulted in a reciprocal air traffic treaty, a continuing aviation effort and could cause any possible harm to the industry, to the public interest and to Slick, itself. He said that, without a hearing, there is no way of knowing if Slick is correct in its allegations.



MODERN TERMINAL Facilities at Mexico City's Central Airport will be improved by money, money, lighting and heating systems. Entire modernization cost \$15 million and additional work will cost \$1 million.

Mexico City Plans Airport Improvement



INTERIOR of terminal includes convenient desks for the new foreign airlines now operating at Mexico City. Terminal handles 3,000 passengers a day.



DECORATION in the terminal includes the clock, which shows the time in seven cities around the world. They represent airlines whose offices serve Mexico City.

Mexico City—in line with its expanded international character, Mexico City's Central Airport is to undergo a \$1 million improvement program concerned mostly with increased utility. Work is to begin that entails an air and better noise review and increase lighting systems, a combination of fuel facilities and additional covered passenger for passengers.

In addition, maintenance is being extended of surveillance radar to complement the present radar system in air traffic control.

Mass lighting improvement will be for the 10,000 x 200 ft. unroofed runway. This area, illuminated with sodium-vapor flood type lights, will be replaced with high-intensity lights installed in CAA 2,420 spot-lights. It also will be installed with sodium-vapor lights. There are three other runways which will continue with the sodium-vapor lights.

Fuel stations now sit unroofed all around the landing field. The new program calls for a centralized fuel-dot system with underground pipes leading hydrants at the parking apron. The hydrants will provide both main and backup. The Apron area at Mexico has two fuel stations.

All travelers will be advised less than present 52 ft. to 75 ft. Two new covered passages for passengers are to be built, one such as the international and on the domestic level. This will double the number of parking bays for aircraft.

The program is to be completed by December, 1978, a task will coincide with the end of the tenure term of President Adolfo Ruiz Cortines.

Engineering plans have been made for a \$1,600 ft. extension of the entire road system to prepare for the arrival of jets to Mexico. Except of this project would be necessary by the necessary diversion of a bank and the appro-

pation will have to be total by the next administration.

There are now two foreign carriers flying in and out of Mexico City. Western Air Lines and Latin Air Lines began last month under terms of the new U. S.-Mexico bilateral agreement which will greatly increase international traffic. At this moment, also, there are nearly 50 domestic carriers such as Mexico City's Central Airport. In all, there are about 280 operations a day, handling a daily average of about 3,000 passengers.

The airport itself is generally considered to be one of the world's most beautiful. It was opened nearly four years ago at a \$5 million project. At that time, it was believed that the facility would be adequate for 20 years.

In addition to its architectural beauty, the airport has some Latin touches. To enhance passenger traffic getting down to business all foreign carriers when reporting to the control tower are greeted with "Buenos dias Mexico" before being given landing instructions. Passengers departing from foreign carriers are given a cup of Mexico's native strong coffee and women are given garlands. Just recently, postcards were handed loose on the top walk landscaped gardens of the palace jet terminal.

Gen. Alberto Salinas Cortines, director of civil aviation, still is considering another Latin touch—a honeymoon room for such married couples to escape from friends and relatives while awaiting their plane departure.

SHORTLINES

► **Detroit-Wilcox** Raa report arrangement will be shared on public sale soon. Contract award and pilot contracts in a 12 year contract, set by Air Lines Terminal Corp. The terminal arrangement has organized formation of the airline group, whose members represent industry and business in the Detroit area. Arrangement could benefit the airport management in the benefit of the entire airline and wisdom of area that are familiar not only with modern business needs, but with aviation as a vital economic factor.

► **Northwest Orient Airlines** has put DC 7s into transcontinental service between New York and Seattle with a stop at Chicago. Flying time for the first class, daily flight in each direction is scheduled in 5 hr. 17 min. each way, 4 hr. 23 min. west bound.

► **E. B. Smith Aircraft Corp.** has received a contract to receive 10,000 acft. DC-6A cargo aircraft to 1979 program.

AIRLINE OBSERVER

► **Air France** will continue Airservices de Mexico's plan to use British Britannia turboprop transport on its Mexico City-New York nonstop flight by the inauguration of Lockheed Super Starliner. It hopes to have them in service on a daily basis by the end of November, flight of Mexico City's busiest season. Arrangements is expected to begin its daily nonstop service to New York in early November. Meanwhile, Eastern Air Lines plan to begin daily service between New York, Washington and Mexico City for the month with the DC7B.

► **C. O. Turner, Delta Airline** chief executive has begun discussions in London with British officials on plans for an Air Canada-Britain route via the U. S. Quins renewed approval to extend its route to San Francisco across the U. S. to New York, and on to London and beyond under a recently negotiated air transport agreement with the U. S.

► **Northwest Airlines** has sold its four B-707 Super Constellation to Latin American Overseas (LAV), the national airline of Venezuela. The four aircraft, which have been used on its U. S.-Orient routes, have been replaced by DC-7Cs.

► **Trans Australia Airlines (TAA)** will soon put public pressure to buy British made turboprop transport and will enter plans to either the 3rd Constellation or Lockheed Electra, TAA currently is buying the Constellation but has doubt regarding its possible predecessor as the long schedule to Western Australia route under unfavorable weather conditions with full payload. TAA has asked Jet Aviation to make certain modifications to meet requirements. If the manufacturer is unable to do this, TAA will probably select the Electra.

► **Civil Aeronautics Administration** air carrier inspectors have completed a working review on logbooks accident investigation. Although accident investigation remain under Civil Aeronautics Board jurisdiction, CAA participation in the investigation team findings allow them the need for corrective CAA action in such areas as aircraft maintenance and crew competency.

► **Proposals** by Shik, Airway, Flying Tiger, American, United and Western Air Lines to extend general passenger rates will be investigated by the Civil Aeronautics Board. Rates filed by the carriers have been suspended pending outcome of the investigation. Rates filed by Shik would have become effective Sept. 1, while the proposed rates of the other carriers would have become effective Sept. 15.

► **Civil Aeronautics Administration** is installing \$100,000 worth of electronic and recording equipment in a C-47 to be used by the Spanish government to check airway aids. The project is being financed by the International Cooperation Administration as a part of U. S. aid to Spain.

► **Heating, Glue Air Transport** and Aerovial, independent British airline operators, plan to introduce four Vickers Viscounts on their north-south service between London to East and Central Africa. Each company will buy two Viscounts to replace piston-engine Viscounts. The airlines have applied the British government and African authorities for permission to operate the Viscounts beginning in October as the Central African States service and thereby strengthen the East African service.

► **Eastern Air Lines** recorded a 61% load factor during the first month of its nonstop service from Mexico City to New Orleans. In 31 days, Eastern flew 1,284 passengers out of Mexico City. Of this amount, 385 continued on to New York. DC-7Bs, with a first-class capacity of 68 passengers, are being used on the route.

► **Air France** has taken delivery of its fifth Lockheed 369A Starliner. The plane was flown from Los Angeles to Paris nonstop in a record time of 16 hours and 27 minutes, a distance of 5,700 miles. The airline has five more planes on order for future service across the North Atlantic.



BULLET

The shot that traveled 2,445 miles

Chance Vought's Crusader was cocked and fired cross-country July 18 in a test called "Operation Bullet."

Aimed along the 2,445-mile F.A.I. route from Los Angeles to New York City, the fighter made it in good bullet time ... 3 hours, 22 minutes and 59 seconds. In fact, a .46-caliber slug would have needed 47.5 more minutes to make the trip at cruise velocity.

Averaging 722.5 mph from start to finish, the Crusader pilot, Marine Major John Glenn, Jr. —

- bettered by 22 minutes the previous course record
- set a new mark for supersonic, high-altitude flight
- made long-distance, high-altitude travel beyond the sound barrier a reality

It was a dazzling show of speed and stamina.

Pilot Glenn moved faster east to coast than man or projectile ever had. Every 4.4 minutes he advanced another degree of longitude across the face of the earth. Over most of the course, he held speeds of about 1,000 mph at altitudes in the vicinity of 50,000 feet.

It was a flight that planned the elements of time. Had the course been flown from east to west, Crusader speed would have virtually neutralized the earth's rotation and the resultant advance of time. Thus, by the clock, Pilot Glenn might have completed the coast-to-coast flight at about the same time he began it.

It was an impressive display of power on land.

No experimental sample of things yet to come, the Crusader is an integrated Fleet weapon right now. Another Vought product of years-ahead thinking that is proving to Air Force today. Dressed in proof that Vought provides challenge creative engineers with the opportunity to work ideas right on through to operational service.

For details on select openings in Vought's engineering team, write today to C. A. Beas, Supervisor, Engineering Personnel, Dept. A-17.

CHANCE  **VOUGHT AIRCRAFT**
CORPORATION DALLAS TEXAS



Mk.5

The Martin-Baker Mk. 5 Ejection Seat is now being delivered in quantity to the United States Army



Martin-Baker
Aircraft Company Limited—England & Canada

configuration for Trans Caribbean Airway Inc. Plans will be met in New York Sea Lane service. Configuration is described as "de luxe" layout.

United Air Lines will receive seats for its prototype to National Football League games that fill it all the way to Detroit about through an arrangement with United and some of the twelve league members. Presumably, tickets to National League games could be purchased only in cities where the games were being played. Detroit Lines is not participating in the program.

Shick Airways sold its C-46s to American Air Export and Import Co., with a lease-back provision involving five of the planes for one year and one for a second year. Deal will involve efforts with Civil Aeronautics Board approval. Shick is phasing out the old planes pending delivery of five new DC-4s. Carrier brought its original equipment, four C-46s, from War Assets Administration in 1945.

Shipping service between New York and Seattle-Tacoma will be inaugurated Sept. 15 by United Air Lines. United will use 18 passenger DC-7s on the route, reports to fly the cautious segment in 7 hr., 40 min.; take 5 hr., 45 min. shortened. New UAL service will be test class.

Trans-Canada Air Lines plans direct weekly service between Toronto and Portland, Seattle beginning Dec. 4. Rapid Constellation will be used on the route. TCA also is planning a new Vancouver service from Montreal via Ottawa and Windsor to Winnipeg and other western Canadian points.

Emery Air Freight Corp. expanded its international fleet with orders to seven additional European cities for a total of 21. The foreign service began in June, 1946. Domestic operations also have expanded but not outside more than 100 airports in the U. S., Canada and Alaska.

Alaska Airlines Inc. by express plan made possible by recently awarded permanent certificate. Plans include introduction of pressurized equipment to AlI between Fairbanks and Seattle, development of new lounge and maintenance facilities, purchase of Decca or Britania telegraph equipment.

Seaboard and Western Airlines from 5,500 lb. of newly selected Post-101 fuel, valued at \$5 million, from Ody Field in New York to a Rapid Constellation. Seaboard uses the fuel, packed in 200 special boxes, now closely guarded to guarantee strict economy.

COCKPIT VIEWPOINT

By Capt. R. C. Robson



The Price of Progress

Careful study of aeronautical problems and constant improvement in the tools of our trade have made for continued progress in aviation. It is likely that a decade has been graduated from the venerable DC-3 to the superb DC-7 and super-jet Constellation. More passengers fly in greater comfort than ever before.

But the big ones after safety is time. Speed is the thing that counts. We constantly struggle to come to fly shorter distances, we use more expensive materials, we use more seats, we use more seats, we use more seats. Before long, most large fields will feature fully-paved runways.

The machine sitting in time is of tremendous importance to passengers as well as to the airlines. But the occasional bumps and cuts for limited activity in the cockpit phase of pilots are not provided with power tools—such as the valuable time, to us, saving of which, can be lost. Controls which are clumsy to us, instruments hard to read, poor seat lights and a host of other items cut off more precious seconds.

Rube Goldberg in Cockpit

All this workage is a large-scale way of getting around to accelerating rate of the most Rube Goldberg invention that has come along in many a day. As a pilot hereafter, naturally I come across portions of the control panel on the latest solid Aluminum Decca-DuPont. Lo and behold it had, not the usual one but three tuning knobs. The first controls a hundred of wavelengths; the next two the last, with.

We cannot be so ungrateful, but I was quite satisfied that the manufacturer had simply been following instructions from Aeronautical Regulations. It is so very possible that such a manufacturer could come out daily until I received ARINC's specifications for airborne ADF systems. But it's true, page 11 clearly shows three tuning knobs. Furthermore, to add to our confusion, I'm almost ashamed to admit that the title page points out that these knobs were "Prepared by the Aeronautics Engineering Committee."

It would be impossible for this poor pilot to possibly describe the varied cockpit dials installed when coming into a metropolitan area. New York, for instance, has three major airports served by a complex system of streams with compass "bumps" holding points, feeding "sticks" etc. A pilot may see Standard, Pa., at 25,000 ft. and find, at LaGuardia, 11 minutes later. In the time, the "wonder operator" has to trace in and identify at least one VHF navigation frequency. And, since there are not "Radio" dials, he must also trace in and identify about one or two frequency stations. The averages are not low. There is also communication and the problem of "keeping the best right side up." There is the problem of making a map to find the right station. There are also several other things.

Time Lost

For once I can remember, an ADF had one "voltage divider" handle. You simply reach without looking and crank until you are in the rough vicinity of your frequency. Then, when time permits, use "fine tune" and identify. Now, instead of two knobs on my ADF's, I have six. Now, because of the proximity of my knob, I can't reach handle and crank, I must either look down or take time to concentrate either by fingertip to arrive at destination.

Most of our major airports are served by low-frequency radio. At holding points as well as ILS system. The ADF is an important cockpit tool. With no such it had to be redesigned for added strength, I'll never know. But if the pilots are interested one of their controllers has put out some of our valuable speed.



ARMY AH-64A helicopters in flight Ft. Rucker, Ala., in formation. Last day of test in Nov was used in 1,000 hr. test. As a result of intensive flying, nearly all major dynamic components have had life tested to at least 160 hr.

Army Begins Cost Cutting Program Based

By J. S. Butz, Jr.

Ft. Rucker, Ala.—Army Aviation is reaching the point to make a major re-evaluation of its helicopter operating needs, officially described in the past as light enough to draw the Army to stop using helicopters in large numbers.

Unique type of accidental success that just completed here is a vital part of a new approach to more conservative rotary wing operations. During the test the Army succeeded in putting 1,000 hr. of reserve type flying on a single Sikorsky H-37A helicopter (S-56) within an month after its delivery. Major components on the overall log book systems, rotors, etc., got 300 hr. or more of running during the period.

Utilization High

This is a high utilization of an actual helicopter and greater than that achieved by most conventional operators of rotary engines.

By contrast it has taken as long as four years in the past for the Army to put the much time on major helicopter types.

For instance the first West 31-21 Westland to fly 1,000 hr. reached that figure just last month although the Army began to receive five aircraft in 1972.

Obviously the Army planned to put at least 100 hr. per month on such operational helicopters, and re-evaluation for change and improvement would be made on the basis of field experience with a large number of aircraft for maintenance and personnel dif-

culties related flight time to 20-30 hr. per month. This low utilization had low expense effects on the helicopter program as a general.

• **Spare parts** were generally overbuilt to compensate for greater usage.
• **Information** on the durability of parts under stress, hours of operational use did not become available for two or three years after first delivery. Much costly retrofit and modification were necessary.

Information about parts suitability is especially vital to reserve type parts being the helicopter. Experience with the rotating quality of rotors was a great asset but not needed the past that designs or maintenance men can predict part life with much accuracy. Test bed data is not completely available in many cases because service conditions are not understood well enough to be duplicated.

Spare Parts

Each design had brought its own peculiar problems and attempts to buy spare on the basis of past experience with other helicopter types have resulted in many errors of an over-handed part cost.

One definite Army purpose was served by the overbuilding of parts. That was to be absolutely certain that helicopter main wear was not grounded through an unexpectedly low service life for any part. However, the cumulative result of over-buying, plus high part cost and low life, high skill required for proper maintenance, and personnel shortages was to raise the cost of the helicopter

program to a nearly disastrous level according to Army officials.

This was illustrated when the Army reported to the Congress that spare parts cost for the Sikorsky H-37As were \$42.83 per flight hour.

The same size cost New York, Army \$15.37 for similar aircraft, which is 6.6 per cent of a conventional type of operation.

Rigorous Expense

Parts replacement is the biggest expense of operating helicopters and for the H-37A this costs the Army roughly three times as much as a conventional. A good portion of this difference can be accounted for by much heavier transport Army equipment gear, on tactical reserves, the lower level of experience of the average Army pilot and maintenance men, variations in accounting procedures, etc. However, a major part of it is due to errors in buying parts.

Army's new program for accelerated service testing designed to reduce annual operating expenses by reducing virtually every aspect of cost except the personnel maintenance and transfer problems. The tests are handled by a newly formed command, the United States Army Transportation Aircraft Test and Support Activity (TATSAT), which was activated during July 1976 and became operational last January.

Objectives of the TATSAT program are:
• **Determination** of spare parts consumption.
• **Rapid transmission** of information about defective design to the manufac-



ARMY H-37A used in accelerated 1,000 hr. test. Program disclosed every spare buying error which increased operating costs. Use of civilian contractor to perform maintenance made it possible to get several shorthrs of leased military equipment.

On 1,000 Hr. Test Results

ture to reduce the need for modified test air traffic.

- **Development** of computerized service life.
 - **Determination** and development of inspection cycles and improvement of maintenance publications.
 - **Determination** of inspection, test equipment, and staff requirements.
- Results of the 1,000 hr. H-37A test indicate that these objectives were met and that operating costs will be substantially lowered.

Service Life

Service life of every major dynamic component on the aircraft was raised and all new have a life of 300 hr. or more, except the tail rotor hub which is still at 150 hr. Typical improvements were:

- **Main gear** has been raised from 100 to 300.
- **Main rotor assembly** raised from 120 to 300 hr.
- **Tail rotor hub** raised from 150 to 700 hr.

Gains in the usable life of these very expensive assemblies (e.g. main gear box costs \$17,249 for the H-37A) is not primary cost to economy. Some other helicopters which have been operating for three years have not yet reached the service life of the H-37A in some parts. Another element of the test which promises great economy but is difficult to give a definite dollar value was the direct contact between the Army test and TATSAT and the Sikorsky engineering department. Military personnel in the past has usually placid at least six

office and six end tape between service field testing cost and the contractor.

Slowly personnel were passed through the cubic test and data was transmitted through files to the main plant. This information was used for immediate design changes in the helicopter under production at Bldgplant. These aircraft will then be much more suitable for field use when delivered to the Army and the maintenance improvements are dated.

Partial order for spare parts for the H-37A test was found to be less than 20% accurate. Some parts were over bought, others underbought, and many not purchased at all. Experience from the test will make more accurate parts purchase possible for production needs and, more important during war will guide the proper parts to tactical units in the field.

Manpower Shortage

Maintenance problems of losing a complete test crew every four or five days of tests than 7 hr. a day for an month cannot be estimated. TATSAT was not authorized Army maintenance personnel for the test because of the current shortage of manpower in Army Aviation. A civil contractor, Test and Development Co., of Atlanta, Ga., was brought in to do the late maintenance work Army experienced. The employees of the company had never seen an H-37 before and said of three had never worked on a helicopter.

Early maintenance is a check upon what is Sikorsky representative but the learning curve period to be steep and

maintenance times went down sharply in the meantime gained experience. This was encouraging in view of the great number of complex systems on the H-37A compared to other helicopters used by the Army.

Maintenance was originally planned for the night shift (living was restricted by the daytime. However, as the test went on flying was accomplished a lot over the usual work week so that the vehicle could be maintained.

Plant Coordination

Coordination of many activities was performed at the Sikorsky plant. This includes were as expected to some cases between New England and Ft. Rucker so that they could be sent to the test for a large number of hours. It also gave Sikorsky engineers a chance to correct the component parts during the breakdown.

Original maintenance records and procedures for the H-37A will be used but considerably as a result of the accelerated test. Tasks of servicing and performing periodic repairs as the aircraft have been reduced by many man hours.

For instance, backing for refueling and attending inspection took one hour when the test started but this time was reduced to 20-30 minutes by test month.

TATSAT's experience during the H-37A test may possibly lead to a completely new type of maintenance program for Army aircraft. These new procedures were tried during the test but many of the test and test maintenance men-hours required result in full scale working aircraft reliability. This accomplishment was possible the result of performing a small portion



Door Seals for the 707

Passenger door seal (left) and galley door seal (right) are produced by CRR for the Boeing 707. Materials: High tensile strength adhesive rubber reinforced with Dacron fabric. Resists: heat, abrasion, ozone and weather resistant seals, non-sticking. Available in various temperatures.

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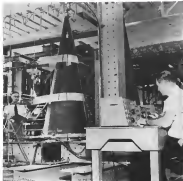


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Vanguard Nose Cone Tested

Static tests are carried out on the nose cone of the Vanguard with airblast loading while at the Windo Co. plant at Balacon. Shown nearby, is conceptual sketches that illustrate model set in within the vehicle tunnel, but here connected (APR. 25, p. 29). Two Vikings and five Vanguard nose vehicles will be launched before the first of the Vanguard launching vehicles is test.

of range revealed each night. As the two done the aircraft was also firm down enough to perform every routine inspection and periodic changes. In this respect the result was not as dramatic as several days for a major overhaul and more critical and inspection those were considered.

Overhaul Schedule

The type of overhaul procedure is common among civil operation adhering to a schedule, but the Amer had not tried it before. One of its requirements is that time on the various aircraft components be staggered so that all do not become due for overhaul simultaneously.

Lt Col Charles E. Hoff, TATSA Commander, is recommending that the new procedures be incorporated in possible future use.

Another finding during the accident test was the weakness of a third crew member for the B-77A. TATSA said an experienced man in a flight engineer to move about the aircraft compartment during flight to check the condition of structure and dynamic components. He was in constant communication with the pilots by radio

and is credited with avoiding serious damage or complete without of the aircraft several times.

Typical emergency occurred during a long cross country flight when three were linked around a bracket supporting the tail rotor drive shaft. The shaft began whipping and shoving other structure, but the cockpit was so far away that the pilots were completely unaware of it.

The flight engineer discovered the condition and a landing was made before another more serious failure could occur.

Third Crewman

Even of the flight engineer are probably most necessary during a test program when failures are common. But TATSA is recommending that such a man in operational crews because of the great use and complexity of the B-77A, can pilot to control helicopters.

The accelerated 1,000 hr service test is but one phase of TATSA's work. Skoote tests are performed on designs that are not far enough along to appear capable of the longer trial. TATSA evaluated three helicopters during its first



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Scheduled for next year are the Hillel II 1133, Baff Y1134, Casco Y1135, Hugin 205, and the French Sud Aviation.

Two aircraft are actually used for the 1,000 ft test. One weighs 1,000 lb and the other will usually receive about 150 ft, so that each of the major dynamic components will be run at least 750 ft before the end of the complete service test. TATSA also has ultimate safety responsibility for two other H 113A assigned to CONARC. Based 6 months test time, so that no failures are based on the performance of four aircraft.

Heavy programs for TATSA test closely resemble service use. Some tests are devoted to pilot maneuvering, subdivisions and maximum performance runs covers are practiced, flights are made in the mountains and in the desert, and usually at high gross weights.

Industry Reactions

One important aspect of the TATSA program is the favorable reaction it has received from industry. Situations, which was directly involved in the first shock test but has high praise for Col Helle and his resources. Other manufacturers are pleased over the test and feel this will improve the nation's performance of all new aircraft.

Disagreements between manufacturer and customer seem to be over the development of complexed equipment and helicopters are no exception.

Generally, the Army's position has been that helicopters were modified aircraft and most designs were not given a manufacturer's standpoint. Civil operations reduced the Army strongly on these points.

Industry's anxiety has been that the Army's test procedures and utilization

have not been adequate for rapid development. Col Helle has stated that TATSA is an outgrowth of these complaints. Fortunately it will be up to the industry to use TATSA data to simplify helicopter construction.

Cost Savings

All are sure, Army and the industry believe that the accelerated tests will eventually result in a large improvement in operating costs.

Unfortunately, the TATSA program is not the complete remedy for high operating costs for Army aircraft. Even if it were able to bring the sa-

trical aspects of service helicopters down to civil level, one primary source of high cost would remain.

That source of cost is maintenance at all U.S. military services, but it is mostly out of their control and is the responsibility of the highest level of command.

It is the same lack of attention to getting constant technical personnel to operate and maintain the increasingly complex mechanisms needed by the service.

Army Aviation is in a very bad spot in this respect. Most of the cost cutting helicopter mechanic training

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Helmet Test

Aluminum safety of human head is used by North American Aviation. Elmer, Manufacturing Laboratory to test three types of pilot helmets. A 12 lb. weight was swung in arcward area against helmets, striking with velocity of 27 ft. Pilots inside head received force of impact.



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Internal Locking Feature: Leaves positive internal locking action, prevents lock wire, lock wiring and other protruding locking devices—space, weight, cost. Yet screw may be easily disassembled with no loss of locking torque.

Some Typical Heli-Coil Screw-LOCK Applications



Flush Nut Assemblies:

Panel is securely locked, but reversibly, because in locked locking feature eliminates need for drilled head hole and also protruding locking devices.

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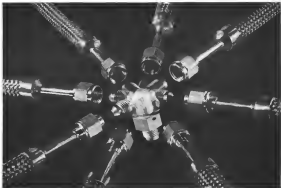
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has no previous experience and about the time they attain production their education is up and they have far better paying civilian jobs. This is an old story but the Army maintenance units are just more than average because they do not have as many upper grade enlisted rates available at the office service. Corporate and private jobs, much of the work in Army units. Re-enlistment rate among these skilled people is 20-30%.

Helicopter pilots leave the Army at much the same rate, further raising training needs and costs.

Command Policy

The retention turnover rate among aviators and pilots is correct over the years. Army pushes into the higher ranks of technical officers who lead and are responsible for its maintenance and for aviation programs.

Current Army procedure is to promote every officer for three consecutive years who reaches field grade rank. It usually shifts every three years or so to a new type of assignment. Even though an officer has an advanced degree and experience in a particular field he is usually transferred to another job background.

It is therefore difficult for an officer to reach the technical competence of representative to most civil work in industry.

British Money Cuts Delay VTOL Project

London—Government cuts have delayed development of the Short SC1 VTOL project, Short Brothers and Harland Ltd. report.

All contract work has been suspended and failure to pass the two sets of Rolls-Royce engines has prevented use of two aircraft on maintenance bases and first test flights took.

The company had previously hoped to demonstrate a four transition cockpit at the SBAC display at Farnborough but owing to the cuts, only the first two flight trials have been completed. Hearing trials will start soon.

The hearing trials are basically similar to that used by Rolls-Royce in the development of the "living test bed" in which the control system of the SC1 was established.

Further trials will be followed by first vertical take-off and flight to complete design and conversion.

The project is an office a portal frame 75 ft wide with a clear ceiling of 41 ft above the aircraft platform. The aircraft has three-dimensional flexibility, can be converted within hours by a cable system which also allows descent and should the control system or thrust fail.

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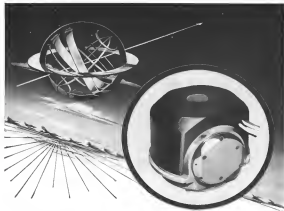
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Revised Organization, Staff Cut Mark Changes in Defense R&E

Washington—Reorganization of the office of the Assistant Secretary of Defense for Research and Engineering will be completed in about a month with a staff reduction from 316 to 157. All but 54 of the 27 to be removed from the post will already have left their desks.

The organization is not part of the Pentagon's current effort to find ways budget cutbacks. It is the result of the realigning of the old offices of the Assistant Secretary for Research and Development and the Assistant Secretary for Applications Engineering, which was ordered last March by Defense Secretary Claude E. Wilson.

Reorganization Table

New table of organization for Research and Engineering provides for two deputy assistant secretaries and an executive assistant. Also at the top level are offices to handle foreign pro-

grams, planning and review and services.

There are seven technical offices in a simplified group that should ease the burden of contractors engaged in research and development work for the Defense Department. They will operate in the fields of astronautics, atomic, biological and chemical warfare, electronics, fuels, materials and ordnance, guided missiles, mechanical engineering and sciences.

Providing overall advisory guidance will help to the Assistant Secretary will be the Defense Science Board, Research & Engineering Policy Council, Canada-United States Committee, Advisory Panel and the Weapons Systems Evaluation Group.

It is expected that WSEG, which has been working almost exclusively for the Joint Chiefs of Staff, now will be asked to undertake specific studies to be done for the assistant secretary. In the past, there has been some con-

fusion of WSEG, based on the assumption that it was involved for the most part with paper studies that did not result in defense action.

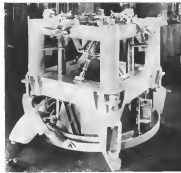
Under the new organization the office of planning will concentrate problems for WSEG study.

Division to give responsibility for research and engineering to a single assistant secretary was made following suggestions of Dr. Clifford C. Brown in Assistant Secretary for Research and Development. The action was taken by Secretary Wilson in spite of advice from Dr. Forrest that the R & D functions should not be combined with Applications Engineering.

Newbury Appointment

First effort of the order to combine the offices was to give the assistant secretary to Plans, D. Newbury, then Assistant Secretary for Applications Engineering.

Newbury had the new combined job such about six weeks. Getting it seemed to require for him in a four year touring light to control the research program but he met a quick response in a clash with the Defense



Stand Tests Rocket Thrust

Weight and thrust mounting stand for the Vanguard motor is shown assembled prior to shipment to Patrick Air Force Base. The stand, a product of the Babcock & Wilcox Corp., maintains steady weight and thrust to an accuracy of 1/10 of 1% (AVIATION WEEK, p. 48). Mounting stand also supports the motor under test loads. Its location on top of the launching platform is shown in the model (right). The stand was designed to withstand maximum full scale rocket motor tests as well as the launching of all of the Vanguard.





Cutler-Hammer Hermetically Sealed Relays Set the Pace for the Jet Age in Aircraft Control Design and Performance

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30 amp single pole, single throw Class A power relay.



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Source: Aviation Week, Apr. 15 p. 26, Apr. 29, p. 27.

The post has been vacant since Navy's departure. Dr. Paul D. Foster, former executive vice president of Gulf Research and Development Co., has been nominated to succeed him, but congressional approval of the choice is not expected until the next session. Meanwhile, Deputy Assistant Secretary John B. Mastaglio is acting in head of the staff.

Algae Hazard Found Facing Space Travel

Delicious flowers and vegetables can be poisonous, according to Air Force scientists, and space travelers could be stricken by their own food and air supply. It has recently been determined that the normal photosynthetic process can be disrupted so that the damaged plants produce carbon monoxide instead of oxygen. Dead plants also cause carbon monoxide.

This discovery has created the need for more study of one of the techniques for keeping crews alive for weeks or months in a space ship. This is to grow algae in the ship to replace the carbon dioxide given off by the crew by oxygen.

Dr. Sewal S. Wilks, of the Air Force School of Medicine, was the physiologist who tracked down this information. His interest was aroused during the investigation of a fatal flight accident. Pieces of muscle tissue from the pilot's body was sent to him to see whether some abnormal condition might clear the cause of his accident.

The tissue showed a high concentration of carbon monoxide and some embedded vegetation. Carbon monoxide was not present in the tissue without vegetation and this discovery caused Dr. Wilks to begin his study.

Company Formed to Study High, Low Temperatures

Plans for research and development in areas where environmental conditions are extreme have been made by Aerospace Engineering, Inc., newly formed research and development firm at Santa Barbara, Calif. Emphasis will be on work in structural electronics and materials.

Company indicates it is developing one type structure for facilities subjected to operation at desired temperature surroundings and which show considerable weight saving compared to conventional designs.

President and chief engineer of the company is Dr. Adam Zaslowski, formerly with Aerospace Development Corp.



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EFFICIENT HYDRAULIC EQUIPMENT**



Vickers flow direction flow valve operates positive flow valve and secondary flow valve to control flow direction in hydraulic systems by rotating the pressure in flow which the valve can produce.



Vickers Thermal Control Valve allows control for primary and secondary flow valve and secondary flow valve to control flow direction in hydraulic systems by rotating the pressure in flow which the valve can produce.



Vickers 500 of Vickers Hydraulic Control Valve Type P1000 is used in the primary and secondary flow valve systems in the Convaair F-102A Interceptor.



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The Convaair F-102A all-weather supersonic intercepter depends on Vickers Hydraulics for the following important functions:

- Primary and secondary hydraulic systems
- Ram turbine operated emergency hydraulic system
- Emergency electrical system

The components shown here were selected by Convaair for their outstanding dependability and the additional advantages they offer in superior performance. Their technological advancement leaves room with correct development. The pumps are characterized by maximum heat rejection and highest overall efficiency . . . all with down flow small size and light weight. For further information, ask nearest office listed below for Bulletin A-3202-D and A-5209.

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CONCEPT of an unmanned drone helicopter lifting blimps John Decker (left) B-61 B-10 (right) could be long transport, flying cross.



Army Seeks Equipment for Nuclear Era

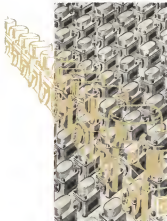
Ft. Rucker, Ala.—U. S. Army is making new appeals to the aircraft industry in hopes of stimulating interest in volunteer development of equipment to meet the demands of Army Aviation in the decade 1963-1972.

Army planners to meet the demands of nuclear warfare has resulted in new emphasis on survivability and mobility, with recognition of five factors of Army Aviation requirements:

- Distances and areas over which the Army must operate will be considerably larger because of the atomic threat
 - Landing areas will be assigned and quickly selected
 - Anti-aircraft defenses will be lethal against aircraft within radius of 25 mi.
 - Effective and swiftness drop elevations will be vital for accurate employment of rockets and atomic weapons
 - Logistics support will most frequent and unpredictable in terrain
- In 1961, Army hopes to replace all its present aircraft with new designs that will meet the nuclear challenge. There are basic regulations that must



ARMY is evaluating long range designs, but economic feasibility must be determined.



from Moog:
over
40,000
Servo Valves



Over 40,000 Moog electro-hydraulic mechanisms comprising more than 700 specific models have been produced. Each model has been designed to delicate specifications by Moog's highly trained engineering staff. The company affirms the high quality, reliability and efficient volume production through which Moog Servo Valves have achieved industry leadership. For complete assistance in solving your hydraulic servo problems, call on Moog's experienced design engineering team.

ELECTRO-HYDRAULIC SERVOMECHANISMS

MOOG VALVE CO., INC. PRIME AIRPORT, EAST AERON, NEW YORK

Research Laboratory, Pomona, New Jersey



AERIAL assault vehicle, a sort of road tank, is now being adapted after perfection of road Jeep. Armed with rockets, it would provide punch for enemy lines.

be included and all of which will at least development of new approaches in the motor.

These include STOL and VTOL, as well as, perhaps, operation from improved fields, low maintenance costs and all-weather operation.

Work already is proceeding on some of these problems through the development of new concepts. An example is the possible use of drone helicopters capable of producing an unmanned aerial control belt. It could be used to move supplies to isolated ground units, bring over ground obstacles or act as a "beak" with reconnaissance.

Development also is under way on a "Flying Crane." The external load will weigh up to 12 tons, the range from 25 to 75 miles.

Fixed Wing vs. Helicopter

Army's attitude toward the helicopter continues to include a good many reservations that lead to the assumption that high-performance fixed-wing aircraft will replace the helicopter in many areas.

Rotary wings will remain used for those specialized jobs that cannot be done by STOL and VTOL aircraft. The time also has come for the use on the battlefield for helicopters and the Army is anxious to see this improved.

It is reasonable to expect that large helicopters will have no place in the arms of the future, and interest is centered on larger numbers of small rotary-wing aircraft. Improvements still are needed in stability, speed and size.

Recent work on tail boom has been the first step toward further refinements of this concept. One possibility is to seal



WELDED nut and bolt, proposed by Bosch Aircraft, is undergoing steel barrel test.

small vehicle, a sort of flying tank that would carry heavy arms and be capable of landing on rough terrain or taking high-velocity rockets.

In the field of fixed-wing aircraft, Aero Industries has a requirement for a replacement for the Beech L-33 and de Havilland L-30. So far, there have been no proposals along this line and some are skeptical about these as well as interested in the state of the art. Nevertheless, development of a new sixth generation aircraft can be started by 1955.

Aerodynamic Training Offered by NATO

Second opportunity is now available to obtain an advanced training in experimental aerodynamics in an international atmosphere under NATO sponsorship. Applications for the annual class of the Young Group for Experimental Aerodynamics at Rhode-Saint-Genese, Belgium, beginning October 1, 1957, are now being accepted.

Course of study includes compressible and incompressible flow and covers a period of 150 days. About 75% of the time is devoted to experimental

PUMP PRIMERS



by Arthur A. Nichols

Greater multiple element oil seal scavenging pumps find increasing application on reciprocating and pressure rise in the newer jet engines.

The rather unusual qualities of the Gardner design which are closely associated with aircraft pump applications from the class of the modern reciprocating for reciprocating engines, can best be assessed by an element adaptability and high reliability.

Engineers find the Gardner pump a most attractive feature since its several elements can be adjusted to meet the application. This is made possible by the Gardner generator design which allows the use of the pump chamber, Gardner design, which, when used with reciprocating engines, can be used to vary the diameter, length and speed of the pump elements to obtain desired capacity. In addition, the packing of this type of pump is completely flexible in location, making for ease of fitting adaptability to the available space and geometry of the engine structure.



Figure 1 shows the Gardner pump design which allows the use of the pump chamber, Gardner design, which, when used with reciprocating engines, can be used to vary the diameter, length and speed of the pump elements to obtain desired capacity. In addition, the packing of this type of pump is completely flexible in location, making for ease of fitting adaptability to the available space and geometry of the engine structure.



Fig. 1

The two pumps which make up a Gardner scavenging pump are mounted on a single common shaft and are actuated through a common drive shaft. A number of pump elements are mounted on the shaft in a common housing. By providing each unit with a separate, fixed length, variable speed, and diameter parts, interlocking, scavenging and transfer strokes during the same or different engine revolutions can be obtained in a single pump with maximum efficiency. (See Page 32.)

Technical assistance plus complete contact engineering and production manufacturing facilities are available to help you in the right pump to meet your performance specifications, specialized requirements, scavenging capacities and engine pumping. Your inquiry is invited.

W. H. NICHOLS CO.
41 Wood Ave., Woburn 34, Mass.

Spectre Fired for Test on Mockup of SR.53 Rocket-Jet Fighter

work with each student receiving a project that affords an opportunity to design, develop, and operate some type of experimental apparatus, equipment. The purpose of this educational plan is to give each student the chance to develop scientific leadership through experimenting and directing experimental work.

Staff of five professors and five technical capacitors operate the center. Their efforts are augmented with lectures and demonstrations by students of international repute. All lectures are presented in French and English.

The center was started at the suggestion of Dr. Theodor von Karman of AGARD and is supported by the governments of Belgium and the United States.

There is no tuition fee and a limited number of scholarships are available for students who would not otherwise be able to cover their substantial expenses.

Application forms and more detailed information may be obtained by writing to Dr. R. F. Huzarova, Technical Director, Training Center for Flight (aeronautics) Aerodynamique 72, Chaussee de Waterloo - Rhode-Saint-Genese, Belgium.

Magn-Thorium Is Used In B-58's Structure

Progress is reported on manufacturing magnesium-thorium at Convair and Wichita is leading to order use of the lightweight, heat-resistant alloy and has already permitted its use in parts of the B-58 Hustler.

W. K. King, Jr., of Convair's manufacturing research and development, said progress has been made which may change future metal forming methods.

The metal, which is annealed before thin shears, is more rigid and much more heat resistant, but does slow to form dies because of manufacturing difficulties. When it was first, it was too hard, with average heating, it is spread.

Convair experiments under King led to development of a system in which dies and material are heated to 700 F in an oven beside a punch, then quickly formed while they are hot.

"We now have established that we can produce straight line bends," King said. "Severed detail parts have been produced satisfactorily."

"We also have learned how to form the alloy in comparatively closed angles and shapes."

Noting that "hot forming" is difficult, King pointed out that new alloy tools will demand machines with "heat" in them to "press" metals into shape. Magn-Thorium alloy is chiefly austenitic, and health physics crews at Convair continuously monitor the metals to assure they do not radiate health.



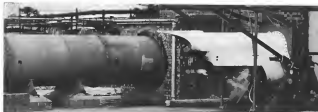
De Havilland Spectre rocket engine pulls white stream as it is fired in static test in mockup of SR.53 intercepter. Fueljet to be installed above the Spectre will be an Armstrong Siddeley Viper.



Cloud of superheated steam from decomposition of oxidant gases. The high test pressure HETP oxidant works as a monopropellant in this phase to drive the pumps and provide rocket thrust.



Fall cloud of steam during start. The airframe test installation appears to be heated and does discharge the exhaust pipe of a rocket or small jet engine test cell.



At 100 Spectre is operating "cold" at 4,000 F and 200 lb. thrust on the decomposition products of HTP oxidant. Close exhaust is due to silver catalyst.



At full thrust the Spectre will jet fuel which combusts with the oxygen released by the HTP and boosts the combustion temperatures to 6,000 F and the thrust to 4,000 lb.



Escorted back to intermediate thrust, Spectre's exhaust still shows typical classical patterns of hot supersonic flow flowing down.

NEW CONTINUOUS HIGHLY SELECTIVE,

Light, Simple System Overcomes False Alarming

ARLHARD, MASS. — Tubes, transistors, relays, and wiring parts will give no trouble in Fenwal's new Continuous Over-Heat and Fire Detector because the Detector sees only of these. The tubes are not only out of it — they never were in it.

This radical improvement in continuous detection is a small, flexible, sensitive tube filled with an inorganic compound, with a nickel wire at its center, and a control unit that receives and supplies electrical charges anywhere in the tube. Because heat anywhere along the tube lowers the resistance of the tube, and promptly triggers an alarm.

The Detector can be called a radical improvement for a number of reasons, but the basic reason is this: the coil filler used by Fenwal gives each startingly sharp drop in resistance with rising temperatures that the length of the loop hardly matters. The temperature response of a one-foot length end of a twenty-foot length of the Detector tube are actually within 10° F of each other!

In short — the bugbear of almost all previous heat detectors, five detectors, so-called arrays, has been licked. With that bugbear licked, look at all the things Fenwal's new system can mean to aircraft safety!



CONTROL UNIT — Operates as components subject to wear or breakdown. Not bothered by shock and vibration. Not per/son sensitive. Hermetically-sealed. Weighs only 8 oz.

No longer do alarm systems have to be set to trigger at dangerously high temperatures in order to minimize false alarming. Set to give the alarm at relatively low temperatures, the Fenwal system will not false alarm, and will give a true alarm instantly — giving previous seconds for remedial action.

Wide-spread fire or over-heat conditions and localized hot spot trigger elements or virtually idealized temperatures.

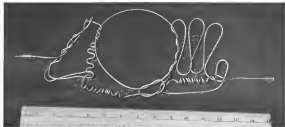
Arrangements now have continuous fire and over-heat detection that is,

in effect, a network of heat detectors, monitoring a widely varying series of temperature situations. Lengths of sensing tube, each set to trigger the alarm at a different temperature, can be placed in a single loop, without one segment's affecting the performance of any other segment.

Fenwal has developed and tested extensively a large family of detectors for service over a range from 350° F to 2000° F.

The reliability and durability to date, in large measure, to the novel design of the control unit. The unit,

FIRE DETECTOR RELIABLE, ACCURATE



SENSITIVE, ACCURATE DETECTOR — So flexible it can be bent into any shape. Extremely low temperature virtually eliminates maintenance-free detection bugbear of false alarming.

small enough to fit in the palm of a hand, is a hermetically-sealed magnetic amplifier which, when the alarm temperature is reached, amplifies the change occurring in the detector loop and actuates alarms. It is light, tough, and not in the least portion sensitive.

Write for full details to Fenwal Incorporated, Aviation Products Division, 121 Pleasant Street, Arlhard, Massachusetts.



Controls Temperature
... Precisely



REALISTIC TESTS — Marking of detection loop (mounted on right panel) is tested with these detectors conclusively that it triggers alarm at same temperature despite variable ambient temperatures along loop and regardless of the length of loop exposed.



TACAN unit shown with covers removed; plane is a composite model.

tube 78-page road map for jets

An 800-foot carrier may be as hard to find as a needle in a haystack, when the plane seeking it is at 30,000 feet and the time is 0.050 hours.

To make the homing plane a homing pigeon, we build the "ARN-21" TACAN equipment illustrated above. Its 78 tubes and associated components add up to a self-contained transmitter and

receiver, rugged in its radio-resistance and accurate to pin-point tolerances.

The manufacture of equipment as important and complicated as this demands perfection, and nothing less. On the military as well as the home front, Stromberg-Carlson has long displayed the ability to take such problems in stride.



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General Offices and Technical Office, New York, N. Y. - Great East Plains at New Hope and Los Angeles, Calif.



Temco Orients To System Management

By Craig Lewis

Bala-Temco Aircraft Corp. has reorganized its engineering department along system management lines as an effort to make the company a stronger contender in the increasingly competitive battle for military business.

To its engineering department along with functional lines, Temco has added a program management group. This move promises to integrate organization designed to bring a project through engineering from initial concept to production readiness under a single manager's office.

Latest move in the organization of engineering operations under the new management concept was the appointment last month of Ray C. Gilbert E. Cole, USMC (Ret.) in charge of Engineering Programs. The senior Cole, who was director of the Guided Missile Division of Navy's Bureau of Aeronautics, program director in Temco's engineering efforts to produce new weapons tailored to future military needs.

Six Basic Groups

This new organizational structure is one of six basic groups in Temco's new engineering setup. All of these systems are functional groupings in which one or two staffs are gathered to do a specific type of job on any project that Temco enters. This is the reverse of the practice of grouping by project in which each project is managed by one aeronautical, avionics expert, electronics engineer and other experts.

Under the new Temco concept, the engineering department is split into six groups—research, development engineering, product engineering, engineering program, experimental engineering and marketing administration.

Lack of these groups performs its specific job on a discrete project as it moves through the engineering process from a design proposal to a finished design that is ready to go to the production line. Each project is guided through the various engineering functions by its program director, making the program director a sort of overall project contractor who pushes out engineering subcontracts as a project to the appropriate sections of the department.

Reorganization of Temco's engineering establishment along functional lines can be traced to two basic factors.

• Change of the engineering pattern has changed from a research and development effort to one of building and demonstrating reliable weapons systems.

• Temco's corporate structure was reorganized along functional lines earlier this year, and the new engineering setup follows the temporary pattern.

The new organization is clearly a reflection of Temco's changing role in the aircraft industry. Where once the company was strictly a subcontractor, now Temco has direct prime contracts of its own. The new system management approach is designed to do a good developmental and design job as the three prime contracts now in the shop, and to make Temco a stronger contender for future prime contracts.

Changed Organization

Vice President for Engineering I. Norris Coffey points out that the kind of organization needed to obtain contracts isn't necessarily the best type to manage the programs once the soldier signs up for them. Now that Temco has more proprietary projects, Coffey says, the job is to compete and "we have found the organization that really fits the problem."

Temco currently has a limited production contract from the Navy for 14 F-111 prime engines. The company also has a contract to develop the X4014 target drone and an anti-aircraft missile called Corvus that is being developed for the Navy.

The new engineering organization is also a good indication of Temco's thinking concerning the future form of the aircraft industry. It is designed to establish and maintain Temco's segment of the expanding missile market.

Most of Temco's income right now

comes from aircraft subcontracting and from making aircraft subcontracts work. The company figures if one member is present there is the aircraft market, but the amount share of the total military procurement dollar will be dwindling over the next few years. Many face modification dates' issue from procurement funds, and Temco feels that business will continue at about the same level.

With this major income stream—aircraft subcontracting—bound to decline, Temco's future growth lies in maintaining its share in the rapidly growing missile market. And the company will depend heavily on its new engineering concepts to keep it competitive in the market.

Subcontracting

"Temco feels that as it develops as a prime contractor, it will be much as the various business—getting together subcontracts in the most intelligent and economical manner. Then, the company expects to be doing a lot of subcontracting in the future. This cooperation in the sense of business currently popular in the aircraft industry that subcontracting will be declining as prime contractors try to keep more of their work under their own coats.

Temco's ideas about the future shape of the aircraft industry also has counter to which field expects that the industry will be contracting as it shifts to the more expensive, more complex, missile production. The company's strengthening indicates that the space area of plant space and the number of workers



ENGINEERING CENTER recently occupied by Temco Aircraft Corp. is 100,000 sq. ft. building depicted at right above is model of company's new Concord, Wis. facility. Office building is at left.



General's B-40 Hercules—the Air Force's first super-sound bomber

Bring your tough ones to Zenith

The super-sonic speed and high-altitude operation of the Convair B-58 brought us new problems in thermodynamics and aerodynamics. The solutions for the B-58—made of resin bonded glass fiber—had to withstand new extremes of heat and stress. They also had to meet the special electrical requirements of this delta wing bomber.

We solved the three-in-one problem by developing a new type of multi-wall construction, combining both laminated and sand-wich structures. To anticipate the increasing speeds and altitudes of jet aircraft and missiles, we have expanded our research programs on high-temperature materials,

especially epoxies and ceramics.

Here at Zenith we welcome problems that are beyond the industry's present technology. They're the kind we grow on. We've learned to form resin bonded glass fiber in almost any shape and size and to produce it by modern production line methods. In most cases, this modern method enables us to simplify the design and tooling that would be required for conventional metal parts.

Zenith's reinforced plastics are the only answer for most structural components—and a better answer for many. We invite you to "bring your tough ones to Zenith".

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New Nose for Tiger

Operational Grumman F11F1 Tiger has latest nose configuration and content as group undergoes on the equipment. The new radome replaces the one replacing boom formerly located in the nose of the Navy fighter. The aerodynamic shape of the nose has also been changed by the increased height. Note, also, the expanded sensor area protruding from the air duct just aft of the gun. The full-bodied nozzle outlet is now standard on all Tigers. This radome, based at Moffett Naval Air Station, Calif., is flown by Attack Squadron 195.

used per dollar rate is roughly the same in the electronics and (7c) security in defense.

That would indicate that as long as military procurement remains at the same level, the radome will need about the same work force and plant space to handle the business as the construction on missile increases.

Industry Changes

Temo's fuel the changes will come in the nature of the aircraft industry, rather than in its size. With fewer, more expensive weapons being built, those companies will have to work as subcontractors on the production of other weapons, according to Yarns. There may be an informal consolidation of various functional skills for new non-military subcontracting.

Temo's began organizing an engineering department in the weapon systems management style in 1954 when the company launched its effort to become a prime contractor. Present an engineering staff of about 350 in 1954, the department has grown to its present strength of nearly 1,700.

While engineering has been developing along these lines since 1954, Temo's really began concentrating on planning a new organization nearly a year ago. The new program concept is the result.

By differences in the new department is Coler's Engineering Program Section. Coler is in charge of the people who directly manage the team project assignments. The approach is flexible, and the program management is set up to fit the magnitude and complexity of the program.

For instance, the TPI and NKDT-1 programs are in charge of project management under Coler's supervision. The missile program, on the other hand, is much more complex and involves a great deal of subcontracting, so it has a program manager.

Under the missile program manager are project engineers for various phases of the program, such as airborne design, support equipment, hardware, etc. Future Temo's programs will be assigned to either a project engineer as a program manager, depending on their size and complexity.

Actually, a project can never be assigned in the new organization arrangement without the management of Coler's section. This occurs when the project is just starting out in either the research or development engineering section.

Temo's research requirements is involved in operations research, market research and development planning. The group applies the "rapid fire approach" to complex systems problems, using scientific, technical and economic skills maintained in research to support this type of effort.

Design Programs

Also working in the field of developing concepts and proposals for Temo's work is the Development Engineering section. When an idea is developed by one or both of these sections into a definite concept, a design proposal is prepared. The next period for engineering and the corporate officers decide whether to offer such a proposal to the military services. If the proposal is offered, and it results in a development

OptiTherm® Radiometers first in Infrared Radiation studies



A Barnes OptiTherm Radiometer is essential for precise quantitative infrared radiation studies of military targets or backgrounds. These instruments are so rugged and stable that they have been repeatedly used in airborne as well as field studies. Barnes equipment was the overwhelming choice of a majority of the participating groups in the pioneering ARDC Infrared Measuring Program.

Barco's F and E Radiometers feature distinctive features, notably sensitive film attenuator to be external, air cooled and shielded photoconductors for specific wavelengths, an internal black body reference standard, for accurate absolute measurements, simple as dual channel operation. Temperature differentials as small as 0.01°C can be detected—with a speed of response in fact as 10 milliseconds.

Advances in isolation and remote temperature measurement are made by developments incorporated with the Infrared Division at Barnes Engineering. They are equipped and staffed in developing your infrared system.

If you are thinking of using infrared, write for complete information on the capabilities of Barnes OptiTherm infrared radiometers, cameras, attenuators and components.



BARNES ENGINEERING COMPANY
 Stamford, Connecticut

Are you on the cutting edge of TECHNOLOGY? This problem, needs of development in infrared detection, will be met in person.



Power for the world's mightiest weapons: ATLAS • THOR • JUPITER • REDSTONE

These are the engines of the great new missiles of America—defense systems of unprecedented speed and striking power. To feed their enormous thrust for power, a new kind of engine had to be created—an engine with enough propulsive thrust to drive tons of projectile in a column as spaced from the earth's surface to the bounds of atmosphere and on through space itself at thousands of

miles per hour.

The answer was the large, liquid-propellant rocket engine. Only a few years ago Rocketdyne, directed by the Air Force, set out on a program to design and build these high-thrust propulsion systems—a job that meant starting from scratch, and writing the book as they went along.

Today, Rocketdyne can report that the power for these revolutionary

new weapons is ready. Engines for the Armed Services' high-priority missile programs are being built in quantity at two Rocketdyne plants—Canoga Park, Calif., and Monrovia, Mo.

The possession of such competence is of crucial importance to America's Free men everywhere as they strive to know that the power for our missile missiles is being delivered—on schedule.

contract, it comes back to engineering where a program manager is appointed to track it through design and development and to coordinate overall subcontract work with Titan's engineering effort.

In development engineering, one grouped the tasks used in defining the technical scope of a project. The action is divided into configurations, study on, analyses and engineering flight test groups. Presentation of concepts to top level status is a good indication of Titan's engineering maturation toward missile work.

Engineering flight test is included in this group because it is essentially a quality control group, a service engi-

neering to be developed as well.

An important factor in the early stage of the Engineering Program action. This group has been formalized to work actively into design from that beginning. Fuller points out that reliability can't be tested into a product after it has been developed, so Titan is going to work with reliability goals from the start and standards right from the start.

Design Analysis

When the technical concept of a program has been worked out in development engineering, the program moves to the Product Engineering section where it is translated into a specific de-

sign that can be built. In this phase, the design is analyzed for stresses and producibility.

Product engineering includes design and production engineering groups. It also includes a modification engineering group which is involved with Titan's military aircraft modification contracts and is located at the Canoga Park modification facility.

Next step is Experimental Engineering section which contains the basic laboratories for after-the-fact testing. Experimental fabrication is also done in this section with the building of models, mockups and prototype.

With engineering management systems, a project is designed and built



Regulus Inlet

Regulus II engine inlet is the 130 lb. flow-weight stainless cutting flow best. Thickness of walls and ribs is normally 0.24 inch and the inlet leading edge tapers to a 1/815 inch end radius. It is one piece with a blind end surface duct for leading boundary layer air which is combusted dumped under the wing. It is made for Clean Flight by R. H. Orlowick Co. of Los Angeles.



SAC Silver Jubilee Newsroll

BY JACK PAGE

 <p style="text-align: center;">FINISH IT AND WE'LL DO YOUR SAFETY SIDE</p>	 <p style="text-align: center;">SHOULD GO UP LIKE AN EGG ON A HOT SKILL</p>	 <p style="text-align: center;">SHOULD GO UP LIKE AN EGG ON A HOT SKILL</p>
 <p style="text-align: center;">LAST YOUR OWN SHIP</p>	 <p style="text-align: center;">LAST YOUR OWN SHIP</p>	 <p style="text-align: center;">LAST YOUR OWN SHIP</p>

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30-channel analog digital computer occupying 500 square-foot analog computer room at RAMO aircraft corporation



Production of aircraft equipment in new Los Angeles manufacturing plant



Data Research Center designed and built by Ramo-Woodridge



One of three new research and development buildings completed this year



First unit of Ramo's manufacturing plant now nearing completion



Input output unit of the Ramo-Woodridge 500 bit analog digital computer

Pictorial PROGRESS REPORT

The photographs above illustrate some of the recent developments at Ramo-Woodridge, both in facilities and in products. Work is in progress on a wide variety of projects, and pictures now available for scientists and engineers in the following fields of current activity:

Communications and Navigation Systems
Digital Computers and Control Systems
Automatic Guidance and Control Systems
Electronic Instrumentation and Test Equipment
Guided Missile Research and Development
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directly within the engineering department as long as it is in the design and test stage. Some skills and methods are developed as engineering and fed out to the production organization when the project is ready for production. That, engineering is a pilot plant for a new product.

On the policy level, Polley has the assistance of a new organizing policy committee composed of the heads of the six sections at the department. This group helps Polley with both planning and administrative problems.

Tennor's engineering department began moving last month into a new, modern facility on Garland, north of Dodger. The new facility, which will be paid for by Tennor's new administrative offices, provides 100,000 sq. ft. of engineering space.

AMC Makes New Officer Assignments

Wright-Patterson Air Force Base, Ohio—Air Materiel Command has announced the assignment of 17 colonels in the Directorate of Procurement and Production.

Previous location varied because of transfer and assignment to the Air War College and the Industrial College of the Armed Forces.

Those assigned to the Aircraft and Missile Division are chiefs of the various Weapon Systems Project Offices are:
• Col. Forest E. Higgett, Interceptor-Missile
• Col. David D. Blatchley, B-55
• Col. Horace L. Linnick, Missile Branch
• Col. Paul E. Hoopes, F-105
• Col. Roy A. Jones, F-102/F-106

Col. Robert J. Meyer will head the Production Office of the Aircraft and Missile Division, and Col. Walter R. Chausson will head the Radar Aircraft Branch. Col. Frank E. Ober will be assigned to a position within the Directorate of Procurement and Production.

Col. Samuel Hale will be technical assistant, Aeronautical Equipment Division. Col. Edward McKibbe will be chief, Communications and Instruments Branch, and Col. Columbus E. Tottle will be in charge of the Accessories Branch of that Division.

In the Industrial Resources Division, Col. William H. Baruch will be deputy chief, and Col. Stanley A. Dallas will be chief of the Accessories Branch.

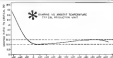
Col. Albert W. Jones will be the assistant deputy director, procurement. Col. Wilbur R. Carter will be in charge of the Production Management Staff Division. Col. William R. Graham will be head of the Contract Management Staff Division. Col. Edward N. Caldwell will be technical assistant in the air

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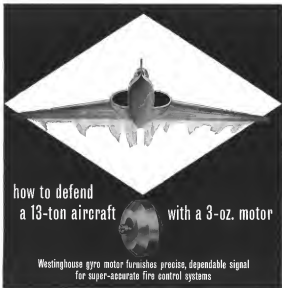
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airs, Maintenance and Service Contracts Division.

Those leaving for advanced schooling at the Industrial College of the Armed Forces are Col. W. A. Stewart Jr., Col. Oliver M. Scott and Col. R. M. Creech. Col. L. T. Embury, recently departed, Industrial Resources Division, assumes Col. Creech's former position as Chief of the Airline Maintenance and Service Contracts Division.

Col. T. B. Aulis, now head of the Resources Branch, Industrial Resources Division, will become Air Force Fleet Representative at Alton, Illinois. General Martin Gary is Indianapolis

Less Trouble In Jets, Ignition Group Told

Sidney, N. Y.-detached representatives of the manufacturers of ignition systems for reciprocating engines gathered to discuss the present picture of the year's Bendix-ServoFlo Division ignition conference. Attended by representatives of the manufacturer departments of most of the world's aircraft, the conference has been held annually to provide the knowledge gained by users of Bendix ignition systems.

Problems to be expected in the overall jet engine ignition systems were also discussed. These will be less true because of the advance in engine size. Bendix spokesmen told Aviation Week, since jet engines the ignition glass acts as an insulative role in starting the engine cycle and not the continuous rate of regulating the spark plug as it does in piston engines.

Bendix engineers said they had successfully minimized most of the new problems and checked problems peculiar to jet engines. For example, they produced an ignition system for the Convair. Weight savings need in the North American which has to operate at 6000' ambient temperatures and up to 50,000 ft altitudes.

The experience used in this case was composed of a stack of laminated, solid steel plates.

Weightless materials of the starting and the ignition and spark stations will be available from Bendix-ServoFlo.

81st Magister Delivered; Two Tested On Carrier

AN F-405 has delivered its 81st Magister by the Lockheed plant. Present monthly production rate of eight units will hit 12. Company has orders for several hundred Magister jet trainers from French Air Force as well as orders from German Air Force. Moreover, two French naval versions of the Magister are at Chesapeake undergoing deck landing tests on the British jet carrier *Hulk*.



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Passive INFRARED Systems Did Need for Visible Light in Photoscoping Objectives: Concentrations and Operations Show Through Concealment.

A low photoneon plane, slipping over New York one dark night in 1963 made this graphic shot of infrared activity on the lower island. And, had it been under total black-out conditions... the picture would be the same.

For this scene was not made with visible light, it is an infrared photo of the heat concentration on the ground—a clear giveaway of the location of people, working machinery, vital installations.

Any time a plane can get through to a target area, it can shoot a highly infrared picture. Inconceivable and inconceivable of personnel show up sharply and vividly. Deception and concealment do not provide protection against passive infrared reconnaissance.

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Exercises Prove TAC's Air Task Force

Foster AFB, Texas—Tactical Air Command has successfully conducted the most ambitious test yet conducted of the Composite Air Strike Force concept.

Combat exercises completed at the Southeast U.S. and overseas were designed to give a cut the planning and management work done by TAC. 14th Air Force, formed here two years ago to develop a highly mobile air task force for use in "brush fire" war situations.

Success of the exercises proves that the Composite Air Strike Force can operate over a wide geographical area and that the U.S. based force can get anywhere in the world in very short order, according to Brig. Gen. Harry P. Vickroy, commander of the 14th Air Force.

Speed By Sea

Under the CASF concept, entire combat ready TAC units are assigned to the strike force on a stand-by basis. When the mission arises, these units immediately come under the command of 14th Air Force for dispatch to the theater spot concerned.

Designed for rapid formation and deployment as an emergency CASF normally consists of a small integrated group—14th Air Force—plus a roster of units from other TAC groups can command it in normal's matter. Under this concept, 14th Air Force's day-to-day job is planning the buildup and maintaining of a strike unit which the assigned TAC units will fit quickly and easily for rapid combat use.

TAC's largest, most complex operational test of this management system was conducted in a series of exercises which included a two-day combat exercise in the Texas area and flights to Atlantic, Pacific and Caribbean points.

Mobility Demonstrated

Using a variety of fighters, bombers and support aircraft, TAC demonstrated its mobility and readiness with these exercises:

- **Power Pack**—largest operation, in which the Composite Air Strike Force worked out a two-day combat exercise involving one Foster AFB in South Texas.
 - **Sea Star**—group of F-800Cs flew over ship to North Africa.
 - **Sea Tiger**—group of F-105Cs ran over ship from George AFB, Calif., to Hawaii.
 - **Sea Star**—group of F-105Cs flew over ship from Honolulu to Foster AFB.
 - **Vista Able**—two groups of B-57s flew over ship from Brooksley AFB, Ala., to the Canal Zone.
- This exercise B-57 group also made good land work of Latin American coastline.



FIRST LINE aircraft in TAC's mobile organization are F-105 (top). Refueling capability is B-57, two F-105 and B-56 (bottom); (below), add to TAC mobility.



Each of these exercises highlighted an important facet of the CASF operation. Power Pack demonstrated how the task force can move into a troubled area and operate on a combat basis in short notice.

Sea Star and Sea Tiger showed how TAC can deploy tactical assets over long distances with the aid of aerial refueling. Vista Able demonstrated the inherent flexibility of CASF—the ability to move into an area where, though it is equipped with a show of force, much as the fleet has been used

as an instrument of foreign policy in the past.

CASF concept grew out of the need of situation it is designed to combat—the Korea War. Gen. G. F. Werhahn, then a commander in Korea and now TAC commander, saw the need for a highly mobile task force, based in the U.S. to respond but ready to move into brush war situations anywhere in the world. Werhahn thought, however, commands were too much invested in the logistic, strategic type of war.

Two factors contributive to the need



TAC markings are shown on Republic RF-4H of 303rd Tactical Reconnaissance Wing.

for CASF is an instrument of war. First is the greatest destructive capability of the Strategic Air Command. Realization of the nuclear potential of SAC leads to the second factor, an operational Command decision to try a technique of swift, preplanned war-like Recon and Intelligence which could impact the Command's sphere of influence without involving the Command's world to control war.

Another factor in the creation of CASF was the development and perfection of techniques for delivering nuclear weapons to fighter aircraft, providing a significant nuclear weapon for each's tool force.

With this background, USAF decided to use the CASF concept, and the 79th Air Force was established at Travis AFB in July, 1957, to provide the planning, coordination and training for the Composite Air Strike Force.

TAC Reorganization

At the time the 79th Air Force was formed, TAC had two groups under its command—North Air Force and 18th Air Force. The new 79th Air Force was attached to North Air Force. TAC was reorganized on July 1, 1957, and 79th Air Force is now directly responsible to TAC headquarters.

In January, 1958, the 10th Air Force had the first proposals for CASF on paper and the job of organizing the force within TAC began. As the concept has been developed into an actual working force a series of exercises has been conducted to test the organizational concepts and to train the assigned units on the newly developed techniques.

In annual parachute exercises, 19th Air Force is a group of less than 100 officers and enlisted men headquartered at Fenton. Their basic job is planning down to the last detail how CASF

should operate and what it will do in such as a great number of theoretical scenarios.

CASF is given a number of specific sites in the world that could develop into trouble spots and detailed plans must be developed to accommodate CASF's function to each possibility.

Moves Quickly

One of CASF's important features is its ability to move quickly over long distances. To maintain this ability, CASF planners must have a detailed inventory of equipment available to them at bases all over the world since CASF's aircraft travels light and must depend on support in local areas. The entire CASF team knows what is available and also must educate units at these overseas bases so they will know how to give the tail force effective support when it is called upon through its arriving to establish operations.

The force carries a 30 day supply of spares and is designed to end a developing task very quickly. If a war develops that will last more than a month, TAC would work with the logistic support forces to take over the tactical air function.

The 79th Air Force provides the organizational function that sets up and coordinates the organization. Within the time to move crews, specifically assigned TAC units move quickly into the operational. The whole force, totaling more than 200 aircraft, consists of three fighter bomber squadrons, two day fighter squadrons, two tactical bomb squadrons, three troop carrier squadrons, a composite reconnaissance squadron and six refueling squadrons.

Supporting these are units for a command element, a composite air control wing and communications unit and a tactical depot squadron, the unit that handles the tactical weapons. The units

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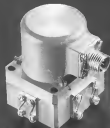
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which make up that force are elements of the North and 10th Air Forces. These two are factors as responsible for maintaining the CASF units at top combat readiness.

When CASF is committed to a war situation, effective assignments are made and the units are dispatched to the combat zone. When it returns, CASF comes under the command of the local theater commander for employment with the other forces in the area. CASF units in the field area peace time, and the first job is to ensure national. The group brings its own air transportable communications, control and warning systems, and those are as

blended. Then day fighters serve for defense functions. When the area is neutral, the officials operate of CASF are brought to base.

Peck was the expert which demonstrated this combat aspect of CASF. The T-104 was established in a theoretical country under attack, and CASF was called on under its usual alert procedure to put out the fire.

CASF operations were concentrated at Farris, with some units assigned to operate from England AFB, LA. Bendon AFB, Tex., and Eglin AFB No 5, Fla. An Air Control and Reporting Center from the 56th Tactical Control

Group, Shaw AFB, S.C. was in Farris, and elements of the Eighth Communications Group, Shaw AFB, operated at Farris, Barksdale, England, and Eglin No. 9. An control element of the 512th Tactical Control Group operated at this base after at Farris, Randolph AFB and Eglin AFB, Tex.

Protecting the Farris operations was a squadron of F-100C day fighters from the 49th Fighter Day Wing at Farris. Also operating out of Farris was a twin engine reconnaissance squadron from 56th Tactical Reconnaissance Wing, Shaw AFB. This unit included the RF-84F for day photo work, the RF-66B for night photo missions, RB-65C for electronic reconnaissance and WB-6D for weather reconnaissance.

F-100C Protection

A squadron of F-100Cs from the 49th Wing went to Barksdale and another F-100C squadron from 49th Wing operated at England AFB. A squadron of RF-47F fighter bombers from the 304th Fighter Bomber Wing, England AFB, operated at Barksdale AFB, and two squadrons of B-16 light bombers from 17th Bomb Wing operated under combat conditions from this home base of Eglin AFB No. 9.

During the war-time combat, the task force flew 1,014 out of a scheduled 1,138 sorties. Of the 134 sorties, 73 were due to aircraft scheduling problems and the rest were cancelled. Due to improved maintenance, cancelled sorties were cut about 100% from the level experienced in a similar exercise held in Vietnam.

Subsequent flying in the exercise (the same rate) represented a historic low due to the units checked out daily. The units met the expected rates, indicating these procedures in a high level CASF aircraft flew 2,092 hours during Power Pack.

Power Pack gave CASF an opportunity to test out and practice its logistical arrangements. Results showed that plans called for too much of some equipment and too little in other categories.

One of the major problems indicated by the exercise, Gen. Viscolla said, is the shortage of spares and ground handling equipment accompanying units covered aircraft. CASF sets a need for more of such items is before operations.

Communications present another problem. Radio relay systems don't provide as efficient communications as CASF would like to have, and the group hopes to get single relayed systems to replace them. Radio is the warning system a superior than CASF would like to see employed. The task force needs tests that can show back approaching assets at a minimum of

REPORT FROM RYAN

New Engineering Opportunities Created as Ryan Projects Mushroom



RYAN OF RYAN AIRCRAFT CORP. AND JOHN ENGLISH (right) inspect architect's drawing of new Engineering and Research Center.

New Engineering and Research Center To Meet Ryan's Expansion

Construction of a modern two-story engineering and laboratory building has begun at Ryan, to meet the company's expanding work in jet VTOL—Automatic Navigation—Jet Drivers—Missile Guidance—Jet Manoeuvring—Robots.

The new facility will provide additional quarters for many of the 1,000 employees in Ryan's burgeoning engi-

neering division. It will also house complex, new chemical, metallurgical, instrumentation, environmental and assembly equipment.

With one in six Ryan employees in engineering, this division has tripled in three years. Its outstanding growth reflects Ryan's increased importance as a research facility in development, production and operations.



RYAN ENGINEER examines structure of jet VTOL cockpit.

Vertical Flight Prabed with New VTOL Cockpit

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Ryan's flight simulation laboratory is a prime tool in the test of new aircraft designs. Both the Vempac and the subsonic, turbo-prop driven Vempac are put through their paces via airbraked flight car. Ryan leadership in this revolutionary new concept of flight is based upon 2 1/2 million man-hours of VTOL research and development. It is another example of how Ryan builds better

Ryan Automatic Navigator Guides Global Flight

An advanced system of aerial navigation, designed for high speed, long range flight, has been developed by Ryan electronics engineers, working under sponsorship of the Navy's Bureau of Aeronautics.

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208 miles. This mission radar will have to increase its stored speed increase.

CASF fighters attempted 245 intercepts in recent weeks which resulted their own during the Power Pack mission. Effectiveness was 57%. Best possible time for the mission was two minutes, the average was ten minutes. Shortest intercept was seven minutes. How the team the day appeared on the table until the intercepting aircraft was in the kill position. Average intercept time was 12 minutes.

Moving Task

The job of moving the task force is complicated by the number of other groups CASF must work with. These include Civil Aeronautics Administration, Military Air Transport Service via Defense Command SAC and others. In Power Pack alone, 19th Air Force had to deal with some of the standard air force, some troops even weeks and over 60 individual units. In the Viet Able exercise two flights of 12 B-57s each made separate flights from the U. S. to the Canal Zone, then made good will tours in Peru, Venezuela and Ecuador. They engaged in fly-by, stunts displays and other air show activities.

The visit to Latin America was a friendly gesture, but it showed how CASF is visible on short notice to "show the flag" wherever in the world there might be trouble brewing.

To demonstrate the long range capability of CASF, operations were conducted in both the Pacific and Atlantic areas. In San Juan, on 1-16-63, five missions from Mobile Base, S. C., to Puerto Rico, then returned via the Azores to England AFB. In San Juan, four F-100Cs, four from George AFB to Hickam Air Base in Honolulu. They returned nonstop from Hawaii to Foster AFB.

For its deployment mission, 19th Air Force has chosen fast weather reconnaissance when they see less than than order through unpredictable weather areas. Instead, CASF will fly to North Africa via Bermuda and the Azores from North Africa, the task force can be deployed to France, Africa or the Middle East. To the West, CASF will fly to the Klamath-Madras-Walla-Walla region.

Long Range Problems

Development of this long range potential is one of 10th Air Force's chief problems, especially an on-site like TAC which is adjusted to short range operations. It requires considerable training to give the normal TAC and the long distance capability, according to Gen. Vaccaro.

Another major problem involved at long range operations is the tanker force

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that must be built to support long outcrop flights for the aircraft, short range tactical aircraft. Over the past six months, CASF has been developing the tanker system around the KR-55 and its three-point probe and drop-in refueling system.

Since SAC runs a heavy course for refueling, the two bombers can not integrate refueling operations, and TAC must depend entirely on the KR-55. An improvement in the KR-55's performance is planned for next year when the piston-powered tanker will be equipped with two J47 engines for a thrust of 25,000,000 lbs. This modification of the KR-55 is being flight tested at Wright Patterson AFB now.

Limiting an important element in maintaining the proficiency of CASF and 19th Air Force plans to conduct two over-sea cruises a year. A Pacific cruise is scheduled for the fall. With the same general objectives that motivated the end of USAF, command, practice is necessary to make use such as it may be possible according to Gen Vercillo.

TAC has switched from the F-54F to the F-105D for fighter bomber missions, and operations are just becoming organized with the new airplane. In reconnaissance squadrons the RF-101 is replacing the RF-54F. This transition should be completed by the end of the year.

TAC expects to replace the C-119s now used as troop carriers for CASF with C-119s in the near future. Some key troop carrier functions were transferred to MATS July 1. CASF's troop carriers are now confined to local operations in the tank force's immediate combat theater.

No other equipment changes in the CASF roster are expected by 19th Air Force for another 18 months. At that time, the F-104 may be phased in to replace the F-105D. Also in the mid-to-late future is the F-105 fighter bomber. Whether it will serve in support roles for CASF.

Gen. Vercillo sees no need for any special equipment for CASF. He said the CASF concept works well with what is presently available and will function well "within present capabilities with some expected improvement."

Plastic Motor Tested In Japanese Rocket

Japanese report successful testing of a plastic rocket engine. Plastic reinforced with glass fibers, reportedly weighs only half as much as conventional metals, reports the scientist, Prof. Eikuro Yoshida of the University of Tokyo. Engine will be used in a 300-lb. space launching later this year.

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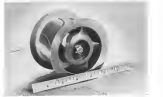
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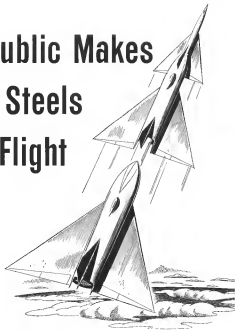
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One reason for Republic Steel's preeminence in this field is that Republic makes a wide variety of steels required. Another reason is its metallurgical service team—field, mill and laboratory metallurgists with years of experience gained through helping hundreds of designers and manufacturers solve problems similar to yours.

Now that the second burner has been passed and the next goal in sight is the "thermal threshold," material selection becomes even more important. To date two materials, titanium alloys and stainless steel, best qualify to meet high skin temperatures resulting from aerodynamic heat. Republic produces both of these metals in billets, hot rolled and cold finished bars, plates, sheets, and strip.

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Our metallurgists and engineers are always available to work with your own personnel to assure that Republic products are best advantage. The service is obligation-free and confidential. Send us the coupon if you would like metallurgical assistance.



STRENGTH IN THE F-105—More than 400 pounds in gross weight, jet engine parts for this fighter include, global hammer are fabricated by Republic Steel Corporation from steels supplied by Republic and other producers. Titanium was selected for its application because of its lightness, strength, and corrosion-resistance. In other, the highest strength-to-weight ratio of construction materials. Titanium's extremely high oxidation-resistance makes it attractive for visible applications, such as fuel tanks. After acid and heat stress during operation, it is now the most corrosion-resistant of all steel and alloy steels. Write for more facts.



ALLOY STEEL IN THE NORTH AMERICAN F-105—In testing—specimens provide strength, toughness, resistance to fatigue. The steels are made by Republic Steel Division, Republic American Corporation. Existing requirements for liner and valve cylinders resulted in the development of new grades of steel by Republic and Republic metallurgical plants working in cooperation with North American's engineers. The new steel, designated ANSI A320, was found ideal for application in the strength range of 238,000-342,000 psi. It maintains its great strength or yield resistance properties. Republic metallurgists are available to help with your projects.

STAINLESS STEEL HELPS SPEED SERVICE—In world's record of 1040 miles an hour, the jet, designed and built by Convair Division of General Dynamics Corporation, is used to experiment, test the effects of such stresses as shock and fatigue tests. The jet's alloy steel parts are made of SAE 4130 Alloy Steel. 1040 steel which has been heat treated to produce steel having Type 227, of which Republic is a supplier. The benefits come as it behaves in service during by absorbing all metal particles at a temperature of 1300°F. The structure helps reduce 1040 in effectively that engineers no longer have to use a concern to calculations of steel performance.

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Structure Tested On Comet IV

Stress and fatigue testing of Comet parts continues at de Havilland's Hatfield, Eng. land, facility. Comet IV nose section and cockpit canopy (above, left) is studied for fatigue testing in small water tank. Comet III fuselage is shown after fatigue testing to destruction at 2040 lb design load (above, right). Comet IV wing skin is shown (center) after fatigue testing. Stress cracking in Comet IV tail panel (below, right) and Comet IV nose cone in fatigue testing rig (below, left) are illustrated.



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Electrical specifications of the Console Recording Systems include a base sensitivity of either 1/1 volt/ohm drive or 1/1 volt/ohm (1) with chart drive on 0.040 type, intensity of 1% with less than 1.2 chart diameter, four 0.005 inch thick (1/16) chart diameter, four (1/16) inch frequency response to 20 cps, down 2 db at 40 cps for all amplifiers to 5 mm peak, unless amplified or peak pull output signals at 1/2 amp impedance (with input lead to ground).

A useful suspension instrument is the new Sanborn Model 240 Programmer, designed to provide a convenient link between an analog computer and the Console Recording System mounted at the top rear of the Console. The Programmer operates the Console in the following manner: response curve recorder drive on—line calibration signals to six channels—read output of computer—close contacts to start computer problem—provide computer output for a great chart length—bars of recorded drive and starts feed for another cycle.

Further technical data, prices and delivery information on the 240, 245 Console Recording System are available upon request from your Sanborn Sales Engineering Representative or at the Industrial Division in Waltham.



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Model GMD

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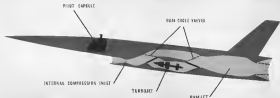
Model GMT

Basically a Model GMD with arrayed thermal-actuated heater, ensuring maximum environmental stability within the instrument. Designed to meet constant but changing ambient temperatures.



Model GDM

Miniature double-operation instrument capable of sensing internal acceleration in two perpendicular directions (e.g., pitch and yaw). Ideally suited for marine and high-speed aircraft flight control systems.



POSSIBLE CONFIGURATION for Mach 2.5-4.0 interceptors shows how the engine might be worked around a dual-cycle engine. The dual-cycle valve is shown in full open position, the position for either turbopump or turbopump plus engine air flows dotted in. Note the internal compressor inlet and the divergent exhaust nozzle. The piston is completely buried inside the turbine in its downward opening position. The exhaust valve is a prototype for landing on the capsule could be shifted up above the fuelage.

F-103 Demise Clouds Dual Cycle Future

Robert H. Cathman

New York—USAF's acquisition of the Republic Aviation Corp. XF-101 advanced interceptor has a question mark in the status of a possible Mach 2.5 fighter. Officially, USAF gave budgetary reasons for the cut (AW Aug. 26, p. 31).

But it is in the feasibility of the dual-cycle engine (the highest speed Mach 3 fighter were not envisioned as a factor though some USAF sources at Wright Aeronautical Co., Dayton, Ohio, indicated that new fire might be "better seas of doing the same.")

A Pratt & Whitney engine, while offering that he did not like to see the XF-101 stopped before it could be put to use as a research vehicle, said that he expected that the road would soon be filled with a competition for another very high performance jet engine, accompanied by a possible competition for a high Mach number turbojet propellant. The new propellant should be superior to the XF-101 as a weapon system since it will be readily tailored into the present U. S. jet engine designs.

Engine Fueling

So far as Republic was concerned, one research engineer said that the company was shocked to hear of the cancellation. It was considered that the expensive new jet program would produce a "breakdown" surplus and as far as he knew no other engine

was working on a comparable aircraft. There was no doubt, and this engineer said the XF-101 would not have been successful in flight test. Another engineer, not with Republic but who has been associated with some of its high speed developments, said that the XF-101 was a higher Mach 2.5 engine with the advent of engine fueling now coming into production under the new engine-old XF-101 aircraft. (The XF-101 was part of the same MX-1011 design competition which produced the General F-102 fighter now in production.)

Aircraft Re-Engining

One possible indication of XF-101 performance is the interest that both Curtiss-Wright and Republic showed in re-engining the aircraft with General's new 70,000 lb thrust jet engine turbopump. It was hoped that the large engine might have improved the F-101 by increasing the maximum thrust performance exhibited by the interceptors when climbing to target speeds and altitudes with the variable Curtiss Wright jet turbopump. (The jet based on the Hybrid Olympus II is the 12,000-15,000 lb. thrust category B jet now under development.)

However, the Curtiss-Wright dual-cycle propellant for the XF-101 aircraft had proved successful. The dual cycle propellant was "Twin" but was in the last stages of development. (See the last August Time Facilities Section of the Aeronautical Engineering Div.)

constant Center, Yulishov, Texas.

Inboard profile driven by Avonics. Wing area approximately 300 sq ft. The aircraft, like that of the also cancelled Novolok, demonstrated by the propellant. Most of that portion of the turbine not occupied by propellant was used for the storage of the tremendous amounts of fuel needed. The XF-101 was essentially a "self-sterilizing" engine. The dotted in position of the dual cycle valve and exhaust nozzle, show positions of these members at idling. The solid positions show how the valve seat is shut off the engine completely from flow during the high Mach operation, during which time the exhaust nozzle's fuel jet would be opened to full divergence.

With the aircraft completely shrouded around the turbojet engine the turbojet's exhaust becomes the barrier for a target track, hence the more dual cycle.

Three Modes
As shown on the schematic graph of altitude versus Mach number, the dual cycle can operate on three different modes: as a turbopump, as afterburning turbojet and a rocket. It would use the turbojet but turned to the flight regime up to the limits of its burning performance. A drawback is that the dual cycle of the engine has to be constant around during the high performance rocket flight.

There are two reasons for proposing the air around the turbojet during the higher speed portions of the flight. At

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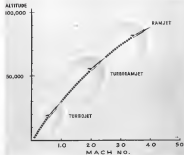
Today, in addition to power packages for many of America's leading military and commercial planes, Fokker has been chosen to build complete, ready-to-install power packages for great, new jet-powered airplanes such as the Boeing 707, the Convair 440 (shown below) and the Lockheed Electra Propjet.

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ALTITUDE-VELOCITY PLOT shows how powered modes of flight envelope. Able to intercept a B-51 type bomber coming down over the North Pole at Mach 2.2 and 70,000 ft, the interceptors would use its turbojet mode up to cycle change-over at 50,000 ft and Mach 2.2. It would only use the turbojet mode in ascent to lose.

higher speeds the turbojet cycle is superior to the pure turbojet cycle and there are no available gas turbine engines which could either cost or operate efficiently at the temperatures which would occur when the 500,000°F temperatures extracted from the gas inlet are incorporated in the turbojet cycle temperatures. These low pressures would make for a very heavy, short-lived engine and there would have a harmful effect on the compressor's efficiency by strongly eating down on the mass flow.

Water Spray

One way in getting around this is to spray water in ahead of the engine letting the heat of the gas evaporate it. This lowers the air temperature and increases the mass flow. If this or other means are not taken to cool the flow before it enters the engine compressor, what started out as an engine state compressor ratio of 9 at sea level sea could end up as only 3 or 4 at sea at supersonic speeds.

In operation, the XF-103 interceptor was to start much like the type of interceptors for which it, Hamilton built its Gyron engine (AVS Aug 26, p. 62). The J67 turbojet is used to start the flow and lead the large afterburner. Both were to power the F-103 rapidly out of the ground and to over 30,000 ft and Mach 2.0 speed.

to about seven seconds without losing afterburner flame, it was expected.

Smaller dual-cycle powerplants and low pressure ratio afterburning turbojets in the Gyron offer possibilities which the engine manufacturers have been proposing to USAF and the contract states between the Gyron turbojets and several turbojet engine powerplants.

The Gyron turbojet while it has increased cost since for its proposed efficiency in takeoff event, can also be shown to be quite attractive in flight in the vicinity of Mach 2.5.

For operations use it would be designed to give large rates of bypass flow to feed an increased afterburner. The bypass region has its further attraction that it would be designed to give good dynamic losses capability combined with reasonably sustained operational operation.

Low-Fan Development

General Electric has considered a specific development of its 179 turbojet in which a large diameter fan stage ahead of the regular compressor stage would be used to feed the bypass flow surrounding the main engine.

Possible costs that demand the higher speed operation the use flow might actually "drive" the turbojet thus making it less attractive in every temperature, the mass turbine. The thrust of this engine and its bypass could be well over 20,000 lb.

Another means for bypass engines with increased afterburners may be possible in that while sea high energy back feed turbojet ramjets and turbine blades may not be used in afterburners without harmful effects.

Corbin-Wright, Allison, Pratt & Whitney and Westinghouse are also



Heavy Duty Powerplants

New engines powering Boeing bomber engines. Pratt & Whitney's J75 turbojet with afterburner, thrust, is rated at more than 25,000 lb of thrust, in contrast to its 18,000 lb thrust J73 (shown). General Electric J47 (see) is rated at 6,000 lb.



This is the brain of ISIP. Developed by Honeywell for the Navy, ISIP (Inertial System, Indicating Position) is a navigator and a primary reference for flight control systems. Using ultra-precise gyros as its basic components, ISIP needs no aid from radio, radar or human pilot. It need only be told the starting point and destination. Non-radiating and non-jammable, ISIP is another example of Honeywell's continuing contributions to the advancement of avionics.

Honeywell
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believed to be conducting serious design studies in this direction.

The model turbojet-powered powerplant, though it has not been manufactured in quantity in the country as abroad, has the compelling advantage of being potentially able to transmit the stable and speed limitations of a turbojet powerplant.

In the present budgetary competition between several aircraft and guided missile nose designers but it will take at least the addition of rocket power to make the next generation of manned fighters able to swing the defense dollar back from missiles. Engines which have been licensed from the X-1 and X-2 programs coupled with the additional equipment expected from the rocket-powered X-15 high altitude research vehicle should pave the way for the rocket-assisted mixed powerplant concept.

Mach 2.5-4 Airframe

The type of airframe which might be built around a Mach 2.5-4 powerplant is also shown in the sketch. The inlet guide vanes would be an unusual design, was built as Republic is using on the F-105. The inlet is based upon the work done at NACA by Prof. Antonio Eber, recently made head of Brooks Polyturbine Institute, Aerodynamics Section.

The F-105 inlet inlet has two



Gatling Versus Vulcan

Navies' Contrary Gatling gun, whose prototype was adapted to one Lockheed's F-101A Mustang development, alongside the so-called 20mm. Vulcan (left) built by General Electric. Old weapon was recently created by Infantrymen. New gun produces 14 times the firepower of World War II fighter machine guns and is powered electrically. Both feature rotating cluster of barrels and are extremely precise.

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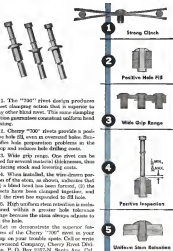
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*Patents issued and pending

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can't dig than the standard types used on the F-104 and B-52 but are available therefore more difficult to use.

The problem of pilot protection is another important item. As shown, it is based on fat over capsules and uses a passage for vision outside cockpit with a visible windshield and canopy materials would be unable to enter the stagnation temperatures which would build up around any protrusion into the windstream.

The superior ribs on rails, both to serve as a cleator for raising the pilot into the glider and as a guide for his downward escape system. Though a parachute has been shown for pilot train, the capsule could also slide for lift up the rails to bring the pilot's head above the stream for use as a vertical brace during takeoff and landing.

Army Contracts

Following is a list of workload contracts of \$25,000 and over as released by Army Contracting Office:

RESEARCH AIRFIELD, Westvale, Ala. R. 3. Proposal of **Wendell A. DeWitt**, Washington, Cal. January proposal, \$25,000. C. P. award, \$15,000. Has demand for 100 to 200,000 sq. ft. (Contract Reported, 10/10/52, p. 1 and 2) (7/14), 10/14/52.

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Chicago, February 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th, 11th, 12th, 13th, 14th, 15th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 23rd, 24th, 25th, 26th, 27th, 28th, 29th, 30th, 31st.

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Today Raytheon, alone among electronics companies, is prime contractor for two missiles of advanced design: the air-to-air Sparrow III for the Navy, the ground-to-air Hawk for the Army. Here, once again, Raytheon's "Excellence in Electronics" is contributing to the security of the nation.



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AVIONICS

Theory Explains F Region Heat Transfer

By James A. Finco

New York, N. Y.—Attempts of the sun to extend into space well beyond the orbit of earth, according to a theory advanced by Dr. Sydney Chapman, be lieve a pairing of ionospheric ions to form first steps of the International Geophysical Year. Dr. Chapman headed the committee that organized the IGY.

Dr. Chapman's theory pictures earth's atmosphere as decreasing upward to density until it merges with the solar ionospheric atmosphere, which is estimated to be at a temperature about 100,000 deg. Kelvin at earth's distance from the sun. This concept would explain heat energy known to be passed downwards by thermal conduction from upper to lower levels of the F region of the ionosphere (150-200 miles).

Solar Atmosphere Theory

The ionosphere has been explored extensively by signal reflection techniques through the F region which has a maximum height of about 280 miles. Very little is known about the upper levels of this height, although some radio waves can be obtained from changes in polarization of signals reflected from the sun and from a stack of whistlers and ordinary light.

Theoretical speculation concerning these regions has attempted to explain the apparently large amount of heat that flows downward by thermal conduction from the upper level of the F region. Calculations have shown that heat absorbed from the sun is insufficient to account for it.

Dr. Chapman has proposed a picture of the outer atmosphere that explains the flow of heat as extremely conduction from a hot solar ionospheric atmosphere. At the distance of the earth's orbit, he estimates the density of the solar atmosphere to be of the order of 1,000 particles per cc. (mostly positive and electrons) with a temperature about 200,000 deg. Kelvin. These figures are in agreement in order of magnitude with estimates obtained from whistlers and ordinary light observations.

At first glance it would appear that a satellite or rocket tracking through such high temperatures would be so heated. Temperature is very high, but the particle density is very low and consequently the ability of the solar atmosphere to hold heat would be very low.

Therefore, a metal object such as



RELATIVITY of the ionosphere, particularly of ionization trails of meteors and of the sun, at 1000 studied by means of two 60 ft. parabolic antennas located at Stanford University in California and Geophysical Institute of University of Alberta in Canada.

a satellite would be able to radiate this heat without damage to itself.

Dr. Chapman formulated his theory by an approach using an ionized solar atmosphere. The solar corona, the high outer layer of the sun's atmosphere, contains a large amount of ionized atomic hydrogen (positive and electrons) at a temperature of about one million degrees, but is accelerated by a steady outward flow

of ions from the actual corona by being both static and spherically symmetrical.

The model corona was taken to be the same density as the actual corona at the point of the latter's expansion. It is postulated a hole was assumed to be one million degrees. By assuming the thermal conductivity of the solar gas and assuming a constant outward flow of it to be spherically symmetrical, a relationship between



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going. The system requires neither
wickets ground aid or altimeter data,
but gives them anyway globally as
a by-product of operation.

GPI's auto navigation is the result
of GPI's pioneering of Doppler
effect in air navigation—no altimeter
and no ground aid is necessary as
the technology of the ground itself.



Every plane a weather station

The solution to the costly problem of unpredictable weather is inherent in GPI's ground speed and drift angle measuring equipments. These airborne auto-navigation systems that tell them where they are every moment, coupled with weather-data-recording units, can make every plane a weather station.

With complete, continuous weather data and perfom reports globally from all altitudes, pilots now will be able to predict next week's weather. To aircraft operators, crew and passengers this means more economical, more comfortable and faster flights.

GPI's self-contained auto-navigation was developed in conjunction with the USAF (WADC). They

have already revolutionized military flight and hold the same bright promise for all aviation as they do for meteorology. The vast potentialities of the GPI Avionics systems have only begun to be explored.



GENERAL PRECISION LABORATORY INCORPORATED, Pleasanton, N. Y.



Knowledge of the earth. This data will be assembled in basic collection centers. Through the USSR, and the United States. Each collection center will present copies of accurate data to the other two centers.

Intercontinental aircraft underway are seeking information in the following areas: Determination of atmospheric charge density; measurement of the earth's magnetic field (and location of anomalous and axial current flows); measurement of solar radiation and studies of the solar spectrum; correlation of low-energy cosmic ray activities with solar and magnetic phenomena; astronomical observations of the upper atmosphere; and related data.

United States reconnaissance will include the Irving 194 high altitude rockets from White Sands Proving Ground, McHamm AFB, Pease AFB, Fort Churchill (Kazania), and ship board launches. Four types of rockets will be fired: Nike Cajons, Nike Decans, Aerosols and Rockets.



• **High-Power Silicon Transistor**—New silicon transistor used for 51 watts dissipation at 25C mounting base temperature is now in pilot production by General Electric. Now in 2N451 it dated for ballast production only next year. General Electric quotes following operating characteristics:

- Maximum collector current: 5 amp.
- Input impedance at collector circuit of cut-off amp: 11 ohms (with 25C base temperature).
- Collector saturation resistance: 2 ohms.
- Beta: minimum of 10.
- Base cutoff: 400 kc.

• **Long-Range Tropospheric Scatter-Radar** tests indicate that range of tropospheric scatter communications can be more than doubled providing wiggly-loop multi channel over horizon wave circuits at ranges up to 600 miles. This experiment, based on more than 10,000 hours of propagation tests, conducted at 400 miles by Lincoln Laboratory and Naval Research Laboratory, at distances up to 550 miles, was reported during recent Western Electronic Convention (Western) in paper jointly authored by James M. Cleveland, Walter E. Murray James I. Roth, and Alfred E. Teichman of Lincoln Laboratory. Highlights findings of the tests include:

- One-way transmission appears to be 5 to 10 db better than ordinary transmission.
- Fading rate and fading surge vary some widely at distances less than 250 miles.

• **Parabolic antennas up to 60 feet in diameter** are required for frequencies above 100 mc and it appears that such larger antennas can be used.

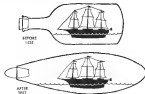
• **Rate at which path loss increases varies considerably with distance.** Rate is as low as 0.1 db per mile between 100 and 450 miles for water masses, but may reach as high as 10 db (0.09 db) in between 600 and 850 miles.

• **Air-Ground Microwave Scatter-Scatter** Research Institute is outfitting P3B to investigate possibility of long-range VHF communications employing narrow-band scatter techniques. (AW June 17, p 96)

• **Rolling Airway Size**—Number of on-off radio receiver antennas on an airplane can be substituted for angle leg-to-be, utilizing multiple increasing frequencies instead of one, according to "quasi-frequency equalization" concept proposed by Drs. W. E. Stock and J. L. Stone of Hughes Aircraft's systems division at Watson. This permits avionics designers to swap off antenna size and complexity for greater equipment complexity at smaller of frequency transmitted simultaneously. One example cited: performance of 10-foot parabolic dish was duplicated by three small wide-band horns arranged in an equilateral triangle in field on a side.

NOTABLE ACHIEVEMENTS IN WIND TUNNEL TESTING—NO. 3

CWT engineers are a dedicated group, providing many open-enclosure tests in the pursuit of basic aerodynamic information. The result of a recent test is shown below.



Basic Aerodynamics

CWT—The Southern California Cooperative Wind Tunnel—in a \$14 million developmental testing facility dedicated to the solution of aerodynamic problems of high speed aircraft and missiles.

Established in 1942, CWT has been concerned with the development of such aircraft as the Hunter, the Super Sabre, and the DC-8 jet transport. Today, with a staff of 800 people, the Wind Tunnel continues to concentrate on projects vital to tomorrow's air superiority.

In addition to its own companies, the CWT also serves other leading firms and government agencies.

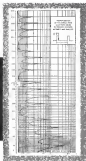
If you would like more information regarding the CWT, you are invited to write us.

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how automatic wave analyzers speed analog data reduction, improve statistical reliability

Automatic wave analysis is probably the least complicated technique for reducing analog data. Feed the taped data to an analyzer, flip the switch, and a complete Fourier series is automatically plotted and printed in permanent record form. There are no intermediate steps, and what little the operator has to do can be trusted to relatively unaided personnel.

Both of the two models available from Devcon can conveniently plot Fourier series data as either amplitude versus frequency or power versus frequency at the flip of a selector switch. Both are also equipped with a "quick look" facility. Model 9050A provides a quick analysis across its frequency range of 3 cps. to 5 kc in 6 minutes; Model 9050A covers its range of 3 cps. to 10 kc in just 15 minutes. Linear or square law output, as desired, is provided by a Brown Electrostat Potentiometer as a large, easily readable plot. You

can visualize results immediately without any further curve tracing. Multichannel inputs permit you to analyze as many as seven channels of data simultaneously. But the ultimate in automation is provided by the addition of a Devcon Automatic Channel Selector, which you can program for serial analysis of up to 14 channels, changing tape speed, bandwidth, and output as you desire . . . all without any further attention.

It must be conceded that, while Devcon Analyzers do provide high amplitude accuracy across wide frequency ranges, no analog analysis equipment could provide the power accuracy of manual and digital computer methods. But too often, that point accuracy is only achieved at the expense of reliable results. The speed with which Devcon Automatic Wave Analyzers can run through data—in as little as 3% of the time required by digital methods—permits such large samples to be analyzed that

Once the data is on magnetic tape, there still remains the job of analyzing it. You can convert it to digital output, normally measure and sample it, and feed it to a digital computer on punched cards . . . but that takes considerable time and effort by skilled personnel. Rather than limit the number of analyses taken and the length of samples analyzed, lets are turning to direct analog analysis, which merits consideration by speeding reduction . . . permitting larger samples . . . increasing statistical reliability.

the statistical reliability of the overall result remains unequalled.

That's why Devcon Analyzers, first designed for aircraft studies, have since been successfully applied to vibration, noise, shock, and flutter analysis in vehicles, aircraft, missiles, and ships . . . accurate interpretation . . . power-line disturbance analysis . . . noise analysis . . . and any number of other phenomena characterized by randomly fluctuating data.

You'll find considerable additional information on Devcon Automatic Wave Analyzers, how they operate, and what you can expect from them in the way of specific performance characteristics in Bulletin 9001. Write Minneapolis-Honeywell Regulator Co., Devcon Laboratories Division, 10751 Hansen Street, Belleville, Maryland, or call Webster 4-2796.

HONEYWELL
DAVCON LABORATORIES DIVISION

EQUIPMENT

USAF Pilots Favor Centerline Lighting

Centerline approach lighting systems and threshold lights were strongly endorsed by Air Force and Navy as a result of recent approach lighting system evaluation by these services.

Tests were conducted at March Air Force Base, Calif.

General conclusions of the report was that "test proved conclusively that centerline approach lighting is a basic requirement for an accepted national standard on approach lighting. With the addition of flush mounted lights within the leading edge . . . a maximum landing capability would exist for most aircraft."

Cost interest in flush lights is indicated by Civil Aeronautics Administration's plans to test various configurations (AW Aug 26, p. 45). But CAA and a possible civil military standard is not an impediment.

Test Equipment

March AFB tests were made with standard USAF outfield lighting equipment with the exception of Sylvania Stroboscopic Condenser Dropback Lights and the Hikka Flash lighting Unit, manufactured in the country by Sylvania Concrete Products Corp. Hikka units are either Sylvania flashers or a General Electric lamp.

Military tests were made at six army types of terrain, including high performance areas which have a very high angle of attack during landings, such as the USAF F-105A and Navy's F-4D. Here are some of their conclusions:

• Configuration recommended consists of 1,000 ft strobeless lighting with strobeless flares and flash lighting units within the 1,000 ft center runway.

By use of the centerline system with flares, the pilot is capable of determining at a safe distance out, or at the normal GCA awareness, whether he is properly aligned with the runway, although he may not yet have the runway in sight.

• Centerline system adds to the confidence of the pilot and considerably reduces the mental hazard of erroneous centerline approaches. It is believed that the system should also increase the safety of any type of instrument approach, particularly following a prolonged flight.

• Centerline lights have a tendency to obscure the side lights leading them off the runway, since their lighting provides

a positive reference for depth perception purposes.

• One of the more problems obtained from the centerline system by both USAF and Navy aircraft was excellent. Centerline was followed in the threshold area to extreme sea level altitude approaches.

• Flush-mounted lights on the leading edge would greatly improve landing capability during maximum bank conditions. Lack of this lighting is the primary reason that the Air Force's landing maximum threshold remains at 300 ft and a quarter of a mile. With the addition of flush-mounted lights within the leading area to supplement approach lighting, a maximum landing capability would exist for most aircraft.

• Flush green threshold lights should be added to mark the end of the runway. Power threshold lights are not as pronounced as the flush lights and are difficult to distinguish in low visibility, present some flush threshold lights extend slightly above the runway and have caused damage to landing aircraft.

• Sylvania and Hikka flares performed exceptionally well.

An advantage of the strobeless lighting system installed at March AFB is that it also takes in the stable system into the next leg field, in some other systems it can take that, all go out.

Here are comments from the Strategic Air Command report:

• Test installation at March AFB was operated consistently during the hours

of darkness when the instrument runway was active. It was also operated during daylight periods of reduced visibility.

• Test aircraft, in addition to SAC planes, were provided by Military Air Transport Service, Air Defense Command, Testbed Air Command, Air Training Command, Coastwide Air Command, Air University, Air Force Academy and U. S. Navy.

• Types of aircraft included B 52, B-47, B 17, KC 97, C 97, F 44, F 102, F 55, F-105, B 57, C 47, B 5D, F 4D, and S2F 1.

Some 395 approaches were made and evaluated. Total of 354 were made under actual instrument conditions and 149 by aircraft from commands other than SAC.

Test Results & Analysis

Strobeless light could be seen at a distance of approximately three times that of reported visibility—when pilot reported one mile visibility. Strobeless was normally visible at three miles.

Centerline lights were visible to the runway threshold, even during mist in which aircraft were to the side of the approach centerline as far as the GCA ten-000 point.

All approaches made with the centerline lights on could have been made as safe landings.

Plans of an approach, such as B-47s and B 57s, were able to judge position sufficiently by reference to the center

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FROM Hikka flush light units are shown under construction in wide area area at March AFB past to test. Lights are located in the end of each concrete "box." Flare units are placed down toward runway ends to provide clearance.

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line lights to complete a corridor as close to the flash approach lights that the aircraft carrier end of the carrier as a landing aid.

Finally of landing closes short during the approach is greater as a result of the 1-17 type as the actual approach speed is close to the stall speed if a case to conventional lights, which reduces the stall speed over rapidly on steep wind angle, resulting in mid- or rear-end backovers short of the runway.

Depth Perception

Flash approach lights give excellent monocular assistance for depth perception.

The flash lighting system within the water run area has allowed pilots to attain the reach desired overtake position in the threshold. The lights can be controlled for flash experiment and are proving to be invaluable tool.

Since installation, over three inches of rain have fallen with no drainage problems encountered. Moisture, 3-17, have reached down sheet and refilled over the flash lighting such as the sensor bar with no design resulting.

As to the Shorecross, the lights provide added visual identification of the exact threshold line on the approach and give maneuvering space for missed alerts.

Navy pilots participating in the flight evaluation tests commented that the threshold system was completely adequate and over the water variables of the threshold could be followed to the threshold, even in extreme sea high stroke approaches. Each pilot commented that the Shorecross lights were useful.

These are single concepts made by pilots participating in the lighting system, listed by type of pilot, they were flying.

F-102: Shorelights aligned at 10 miles bearing flash lighting guidance from Shorecross missing base. Flash lights a little brighter. Set to cockpit so that controller was directly over nose. Had controller in sight till about 4 mi, but no went because you were off and lost over the carrier, you always look a little to one side. This controller is in view all the way to the threshold.

Another F-102 pilot added, "Controller in sight over the nose or complete approach. Never did see side lighting controller is so outstanding."

B-52: At 3000 ft. when velocity was reported as less than 4 mi. top of base 4,500 ft. Shore lights could be seen 3-24 mi. climb angle on heading 275 to 300 deg and up to and down of field.

F4D: Controller and Shorecross adequate over nose. They are excellent. Flash lights brighter, but OK. Real low water.

F1D: Controller OK, that's all I need. Side lighting not needed.

CG-9B: Shore lights were seen a minimum of two miles before any other lighting. Another CG-9B MATS pilot added, "In low range it was noted that there was considerable place missed with the Shore lights while still in the airway. This was proved disturbing to a pilot. Also perception seems to be affected noticeably before landing with the Shore lights on. Recurrently Shore lights be missed on left side of approach to landing end of runway. Shore lights most effective in the condition, 3-5 mi visibility with bright."

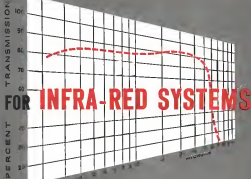
Comments regarding roll bar lights was, "In most cases, pilots are not sure whether the roll bar will be extended edge lights were on or off during run, thus indicating that they are definitely not a necessary but rather a luxury. If installed, they should be white instead of red."

OFF THE LINE

Aerovox Corp. has been appointed East Coast distributor for New York. An Aerovox line of monopropellant attitude indicator, propeller control and electric motor drive systems. Shorelights and space are available at all five of Aerovox's branches: Albany, N. Y., Miami, Fla., Atlanta, Ga., Cleveland, O and Washington, D. C.

Assets of Precision Components, Inc., New Canaan, N. Y. have been acquired by Servomechanisms, Inc. designers and producers of electromechanical control apparatus for aircraft and missiles. Everson Components produced a precision tachometer generator which has been incorporated in the line of products of Mechanical Division of Servomechanisms.

Contracts totaling nearly \$100,000 for power generating equipment and associated generator sets have been awarded by Consolidated Diesel Electric Corp. from the Civil Aeronautics Administration and the Navy. CAAs order is for 57 units of 10,000 watt output units and 33 of 30,000 watt output. Units supply electric power attainable in case of successful power failure. Generator feature a special



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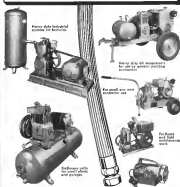
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A special fitting for a jet engine removal track. CAST BY LEBANON is precipitation hardened stainless steel for the clean tolerances, dimensional accuracy and surface smoothness required by the design. A significant example of how Lebanon foundry engineers were able to successfully produce a casting which substantially retained the original characteristics of a machined part, at a major cost saving.



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This remarkable new cable is made with either copper or stainless steel core insulated with entirely new Packard silicone compounds. It's flexible, easy to handle, and it's strong enough to withstand the rigors of installation.

The new built-in sheath is tough, dense and compact and has high dielectric resistance. Added density throughout the insulating layer helps overcome almost all problems of compression set and there are no signs of the soft sponginess so typical of ordinary silicone cables. What's more, the insulation has great resistance to dielectric strength.

The new Packard Electric development was designed to meet the higher heat conditions encountered by modern aircraft. No other silicone cable equals the performance of

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TURBINE FACILE installation (left) shows an outboard of new Avco burner (right) skids (right) points up wide wings of rocket stability, V tail located above jet nozzle exhaust. Turbojet engine takes an outboard high out of water spray area.



NEW WHEELS-DOWN LANDING (left) new gear which can retract downward from top of fuselage (shown in design position). Sketch (right) shows fuselage in normal position for landing plane on water. Main gear is retracted up to keep wheel clear of water.

Turbofan Seaplane Will Fly Next Year

By Irving Stone

Van Ness, Calif.—Extraterrestrial, 340 mph cruise, 8 place seaplanes with optional accommodations to be designed as a cooperative enterprise by a group of West Coast engineers organized as Air Craft Marine Engineering (AW Apr. 1, p. 34).

Project plans, strongly reinforced, anticipate that a prototype will be flying by middle of 1958. Final design of the plane will be completed at the 10th Annual National Business Aircraft Assn. Meeting, Denver, Oct. 2 to 4.

Design Features

- Design highlights of this new executive and family transport include:
 - Advanced hull design incorporating best NACA hull test data
 - Blastproof hull exterior
 - Passenger cabin-overlaid structure and seating layout
 - Wide range of cockpit layouts
 - Retractable outboard motor to ad-

justing plane in confined waters.

Mid 1958 flight trials to be dependent on sales acceptance and additional financing, as well as extensive use of subcontracting in tooling and assemblies, and full time participation by most of the new partner staff.

Estimate is that engineering is now about 50% completed.

Target price is \$125,000 for basic airplane based on production of 50 units per year.

Price is being designed to meet CAR 94b requirements to make it suitable for commercial transport.

Two jet propulsion stages was selected for its increased versatility and to meet need for high speed performance on the water. Top speed of the amphibian is projected at 375 mph, cruise at 340 mph.

Design philosophy was to carry the gap between water and land based aircraft, exceed performance of conventional light twin-engine amphibians in this general weight and price category.

Principal refinements to extensive drag of typical stretched configurations are incorporation of retractable wing fairing for 25 percent reduction in hull drag and streamlining of wing fairing through use of spars which are also channels of main landing gear.

NACA Hull

Hull is designed in line with latest National Advisory Committee for Aeronautics hull test configurations. Rounded nose top, closed nacelle, better displacement non-suction and conventional midline hull drag, according to president and chief engineer Robert M. Foss.

Full length spray drain control the gross water drag, lift-off and landing rates. This provision operates in such rough water as would be prohibitive with an undrained hull to close.

NACA data, on which hull is based, indicate that inland craft be offered in 3 1/2 hours, three dollars. Engine burners but inlet lip above

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You can often reduce a crowded station of gears, universal joints and other parts in One Flexible Shaft! Flexible shafts also make repair design possible... allowing new freedom in locating connected members to save space and facilitate operation and servicing.

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using leading edge to prevent possible pin and feather action.

Body is automatically lifted to a longitudinal and vertical line to insure maximum aerodynamic efficiency.

Now is continued to incorporate a valve for 50-psi surge, scuffing and any and ground turbulence. Rotor engagement is changed a process therefore which gives rise of water action and also accommodates the forward extend of rear gear. Movable door at above displacement water line to allow such possibility of being for future sloping over deck, affords good downward visibility.

Cabin Pressured

Cabin is pressured by NESS hand-operated hand-pumped manual source. Expansion except over pilot and cockpit loads also affords visibility aft of vertical. Pilot seats are separate fully articulated reclining-type seats.

Two large windows are provided on each side of cabin aft of wing-panel windows. Rest of cabin also is glazed with an oval window also serving as an emergency escape panel leading to the fuselage.

Passenger seats are in two rows spaced at 40 in. and accommodating three people each. Forward row saddle seat can be folded between seats on either



HELL cabin structural members are shown in assembly drawing. All portion includes seat for flight member, combination sight panel and forward attachment frame.

side to permit entry to rear row and convenient moving from rear to front seats in flight. With lower row saddle seat folded, full standing headroom is available in a depressed aisle.

Cabin is hand with emergency floor for seated passengers and shock absorbers without shock on hand in such landings.

Cockpit instrumentation is laid out on a pressure panel so that all instru-

ments can be observed by each pilot by turning the head. This symmetrical configuration also provides space for electrical instrumentation, communication and navigation controls, so that no involved panel is required. Entrance level is well up from deck, but is being studied with other less experienced aviation pilots. Best one.

All cockpit outside-chest panels and controls are suspended from forward bulkhead by using floor supports for investigation and clearance of foreign object protection.

Baggage compartment aft of cabin is accessible from cabin by sliding down middle rear seat. Accessibility also is provided through spacecraft floor outside.

Landing Gear

Main landing gear is located beneath wing just aft of cabin area. It is a levered suspension type with Cleveland Pneumatic Tool Co. liquid spring shock absorber. Because of the low landing speed (47 mph) it was felt that the extreme long travel available with the levered suspension would prevent landing and takeoff from rough unprepared fields. The levered suspension problems listed above are both during rough field landings, and high reaction rate advantage is considerable with the small profile level of the liquid spring item one.

Spinner has two positions—down for wheel landing in which wheel contacts true contact surface of ground and forward position in which spinner is a roof for static and low speed takeoff stability. In forward position the wheel linkage lever, which is retracted fully programmed with spinner wave nature, acts in a preform out of the water.

Speed brake also enters as a firing

Arnie Amphibian SPECIFICATIONS

HULL	.....	38 lb.
Length	.....	11 1/2 ft.
Height	.....	55 in.
Cabin inside width	.....	41 1/2 in.
Cabin inside length	.....	75 in.
Cabin volume	.....	280 cu. ft.
Assemble baggage volume	.....	87 cu. ft.
Displacement water plane load	.....	5 lb.
Density water, sea level	.....	14.4 lb.
Wing span total	.....	12 ft.
Wing load	.....	15 lb.

WING

NACA area 7 section	high location low cord modified by EAC	
Span	.....	46 ft.
Thickness, root	.....	15%
Thickness, tip	.....	12.2%
Root chord	.....	96 in.
Tip chord	.....	46 in.
Wing dihedral plane dihedral	.....	1.5 deg.

TAIL

V type conventional NACA 6400 series section		
Span	37.5 ft.

WEIGHTS

Gross	.....	9,080 lb.
Useful load	.....	3,600 lb.
Fuel load maximum	.....	5,236 lb.
Range (480 gal. fuel) 1,814 lb. metal load	.....	1,894 lb.

its spines leading edge which supports a structure, or length of forward side of spines wall.

Hull Structure

Basic hull structure is produced first on a millly design, and second on producibility. Because of the higher support requirement of a resin-based hull, the optimum arrangement for a crash survival design was set with the basic structure. Stress points are identified and seating equipment is designed on a structure with findings. In A-CI (Aviation Crash Injury Research) of Cornell University. This provides a structural load under passenger con-

ditions, to which ductile seat structure will be attached with IBC connections. Stress studies.

Main structural hull members include large magnesium castings on which a stainless steel or aluminum will be applied, he says. Castings and sub-assembly design to give highest strength weight ratio. This technique covers the material as far from the neutral axis as possible and offers high oil bearing sections with latent metal stress.

These castings include wing spar through members, step and auxiliary step frames, combustion engine mount and tailcone attachment frame, seat frame

and nose wheel casted at both frame.

Spar through members, step frames and engine mount frame are to be epoxy welded to a longitudinal tubular fibreglass reinforcement structure serving as an supporting arrangement. Reinforced ribs and nose wheel attachment frame are epoxy welded.

External skin from nose to step and from tail to fuselage is a single layer cross-ply with Fibreglass fibers and cover bonded with epoxy resin. Left and right side skins are bonded to wing spar frame and tail. External structure steel attachment strip towards tail section is bonded to epoxy resin in the area from structural supports with reinforced or floating sheets.

Separate fuselage assemblies are used fibreglass braided panels bonded to the rear magnesium frame, one for shoulder attachment, the other at the rear step.

All fibreglass honeycomb skin paneling allows relative light weight, high impact resistance, and leak protection. If outer skin is perforated, inner backing still allows closure. This Fibreglass panel construction is easily repairable in the field. Resin infusion.

Flat fibreglass honeycomb panel form is bonded to upper side of fuselage frame to complete the longitudinal box structure.

Wing

Shoulder height wing is placed to envelope through three door pins one anterior on each side-two on each spar and one on rear spar.

Wing structural headframe includes three magnesium cast rib-one rib, root rib and tip rib. Spars are healthy sheet channel sections reinforced with additional single spar.

Leading edge nose box on each wing spar is in a fixed and constant use of a single-piece Fibreglass skin and Fibreglass oil tank fitted with airway bypass. This structure is bolted to the front spar.

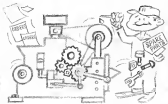
Lower skin of wing main box will be aluminum or magnesium alloy. Upper skin is an aluminized honeycomb panel.

Wing box is designed around a complete honeycomb, low contraction material including both distributed area suction and super-contraction over the flap and aileron. The IBC structure will give STOL performance—less than 100 ft ground run over 50 ft obstacle. Excellent.

Reinforcement of wing box prevents racking hull in its condition. The IBC gel bladder type oil tank with self-healing for protection in hull oil or cabin will be eliminated.

Stiffened flap and aileron structure has mounts only of cast end ribs, sheet metal channel spar, reinforced metal

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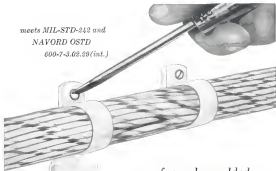
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also, and located in glass plastic case. Top tests, precision adjustments requiring 55-grit emery, are designed to reduce induced drag and wing bending moments.

Engines

Pompeplots are Continental Model 420 (Turbosax) turbofans rated at 750 hp normal thrust. These were selected because of the high propulsive efficiency evident at the low specific fuel consumption at relatively high cruising speed (140 mph). Burner design. Also, the bypass feature effectively serves as a high efficiency pump for the REC system.

Engines and auxiliaries will be installed in a plug-in power pack, at corners of landing edge and landing, burner area. Engines will be handled with a dolly on tank removal and replacement will be able to be effected in a total time of about five minutes including hookups to pumps.

Engine position, behind cabin, will reduce noise and vibration.

Tail

V-tail was selected to take the pressure out of the jet nozzle stream, also place it above the canopy (slight overcut tail) (space). It also improves forward visibility through cabin rear window.

Tail control with the V-tail is still over an extent of failure of one engine because of the small displacement of the thrust vectorline from tail centerline.

Construction of the stabilizer portion of the V-tail, as well as stabilizer control, is similar to rudders and ailerons.

Outboard Motor

Novel feature proposed for the design, which has applied to plans which have been approved by the FAA, Burner unit is an retractable 70-hp outboard motor, located in the tailcone, and electrically started and stored, to permit pilot to cut jet engines after landing and to taxi to dock at mooring.

Autolite fuel system, Burner claims that it-pool water rudders are self-storing in gusts at low speeds, and operation of jet engines at controlled maneuvers or maneuvers controlled landing would be made possible from standpoint of jet start and stop.

Outboard motor would give speeds up to 11 mph in quiet water, enable wing the craft as it can occur without landing jet, Burner says. Weight penalty assumed for this installation, even a typical water rudder, would not be more than 30 lb., he claims.

If powered land operation is under way, the outboard motor could be stored and stored.

Instead of 10 minutes the amphibious will be fitted with complete pneumatic system for inflation of landing gear.



Airpower Shows Its Progress

Formation of USAF Douglas B-66 jet bombers flies over Andrews AFB, Wash. Along Golden Anniversary at show put in Fokker D-XXII and Nieuport 28 replica World War I fighters which also took part in show (AFW Aug 25, p. 134) held in country.

Apt, attachable step landing gear (heel steering, speed brake, and outboard motor). Swivel will be a 5,000 psi inflation rate incorporating mixed cylindrical plastic reinforcement having reinforced supports for the complete operation for constant service below calculation. Fuselage system not selected because of weight savings which reinforcement, ease of maintenance, and elimination, Burner claims.

Calcs (approximately 3,000 ft) pressure altitude at 25,000 ft) will be led by nose boom-up pressure (led by turbo-fan thrust) which possess the most powerful engine.

Organization

Aviation organization branch of old time organization. It was formed in September, 1954 as a composite of 12 aircraft of 20 engineers with various major aircraft companies in the Los Angeles area. Burner flew about 25 years experience and 12 engineers have joined the other part.

All of these people some of whom are engineers with considerable responsibility, participate on a time base basis in the design of the amphibious and re-

duce equal in the company for their engineering services. Reassignment in the form of stock is tied to a scale reflecting their experience and present earnings.

Chief engineer and president Robert M. Burner, has been succeeded with Lockheed Missile Systems Division.

Member of the board of directors is Ernest E. Short, well known Lockheed scientist.

Director of customer relations is Jim H. Halks, well known in aircraft sales markets.

Project to date has been supported possible by access to the participants group. Capital in the corporation is being extended by members of the group and selected outsiders. Personal work-engineering analysis, design drawings, and fabrication of test equipment, together with full scale development being carried on in test points require here. Construction of new facilities (mainly in) is scheduled to start the fall over San Francisco Valley Airport. That will give room for prototype development and initial testing. Additional land areas sought for quadruple expansion for production.



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New Lockheed Jet To Visit NBAA Forum

Lockheed's new CL-129 18 passenger light jet aircraft program is expected to be displayed at National Business Aircraft Assn's 10th Annual Meeting & Forum at Denver, Colo., Oct. 2-4. More than 700 business pilots and executives are expected to attend the forum.

Other new business aircraft that may show up at the NBAA meeting include the four-place Piper Conquest and two-place Viper 44 helicopter. Turbojets and jet conversions will count in its logistic discussion during the meeting. Among the manufacturers that will be represented are Lockheed, Grumman, Vickers, Fairchild, On Mark, Allison and Piper.

PRIVATE LINES

Lightline's second round attempt will be made early in September by Tom McManis, Jr., who plans to fly a Mooney Mk. 28 four-place business plane from Houston, Tex., to Rome via the Canal Canal in approximately 40 hr. Money will have three of four seats reserved to allow substitution at 210 gal/hr fuel consumption, normal 50-gal capacity, providing an estimated 500 mi accuracy at the end of the approximately 5,000 mi trip. Current official seat plane model was set in 1944 by late William Odion who set a Beech 18 business aircraft at 497.2 hr. from Honolulu, Hawaii, to Tehran, N. J.

Aerial survey for radioactive materials covering 6,000 sq mi of Southern Nevada is underway by United Kingdom's Atomic Energy Authority. A Boeing Crophunter Ltd. survey plane is being the area at 450 ft altitude according to radioactive materials data on which information will be published as map lines and posted in several public places for use by inspectors.

Lightweight engine system for small plane use, weighs only 13 lb and outputs 10-hp, is being tested at a half-ton in 18,000 ft. Bucker's Scott Aviation Corp., 575 Elm St., Lenoir, N. Y. Cost is \$115.

Trans-Canada Pipeline Co., Toronto, purchased a 14-passenger DC 3 conversion from Revenue Western Inc., St. Louis, with 76-W Super II engine, Edison fire detecting system, Sperry II 5000 transponder and C-11 engine. Collins VIII avionics and transmission, and T1R VHF omni navigation system on with radio magnetic induction and Rev. 200 flashlight marker beacon system.

Beech B155 Bonanza who flew non-stop from Fresno, Calif., to Kingman, Kan., a trip of 1,270 mi in 5 hr. 17 min., averaging 21 miles per gallon. Distance covered 1,178 mi. specified as range for B155 with standard tanks in company's data sheets. Total journey was made using plane's automatic mixture control, three-way at least 14 min. fuel increasing after landing at Kingman.

ADF Station is title of 80 page booklet being more than 5,000 brochures in U. S., Canada and Mexico prepared for pilots and business firms in Lear-Coll Devco Inc., Santa Monica, Calif. Price is \$3.

All Cessna OE-2 luxury planes ordered by U. S. Navy are fitted with Gyrovac automatic heading gear to increase safety.

Activities of Industrial Products Division, International Telephone & Telegraph Corp., including lightweight fuel cell autopilot unit is being transferred from New Jersey to the West Coast & V. Deltair a new sales manager for the autopilot line now certified by FAA for Beech C-19 through B15, Cessna 172, 180, 352 and 310, all Aero Commander models. Radio-type installations are in process on the Piper Apache and Beech Twin Bonanza.

Contract to equip Eastern Dew Line area in a year would have been let to Koning Helicopters, Ltd., Toronto, using three Sikorski S-55s purchased from Petroleum Helicopters,

Inc., New Orleans. S-55 type helicopters previously used in Dew Line support missions have each carried up to 4,000 lb. tank and average 30,000 lb. loads over two-week period.

Because of \$180,000 in operating capital has been ordered by Van Dusen Aircraft Supplies under a 10-yr agreement with Prudential Insurance Co. and Northwestern National Bank, of Minneapolis. Van Dusen forecasts net sales volume of \$4 million this year.

Rotational maintenance contract on Boeing C-97, running through July 1976 has been awarded by Army Aircraft Corp. at Greenville, S.C. facilities. Aircraft shops in MATS method and modification plan to provide periodic reconditioning, according to the company. Ground the also has an extension through October of this year as an other USAF contract to modify and overhaul C-97s.

Superior automatic engine power law induction system installation on Cessna 180 has been certified by FAA. Superior Type Certificate 78A-125 Equipment is also approved for Beech 18, other certification are pending.

Silver Anniversary party will be given by East Coast Aviation Corp. in its new 5182-200 hangar at Balding Airport, Livingston, Mass., Sept. 25. Plans started on a long school, currently has several classrooms, cooking school and engine overhaul equipment and safety (also maintenance, special-ized operations, aircraft and equipment sales).



Cabin For Gyrocopter

Flagship cabin has been developed by Bensen Aircraft Corp., Raleigh, N. C., for two-seater Key Gyrocopter's B-70 Gyrocopter, which can gather payload to obtain forward thrust while 2000 rpm for vertical lift capabilities. Gyrocopter is scheduled to hit market by late 1976 at price ranging from \$395 to \$495, 100 cc engine. Takeoff speed is about 23 mph, landing speed 7 mph. Cabin air landing and distance is about 18 ft.

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CAR Accident Investigation Report:

Lodestar Spun In For Reasons Unknown

A Lockheed Lodestar model 3514 N 28365, owned and operated by the Phillips Petroleum Company, crashed and burned 54 miles southeast of the Bartlesville Okla. Municipal Airport Dec. 12, 1956, about 25:37 P.M. Both pilots and the co-pilots were killed.

HISTORY OF THE FLIGHT

The purpose of the flight was to take six passengers of Phillips Petroleum from Bartlesville Okla. to Salt Lake City Utah Company Pilot Joe Mark Ross and co-pilot, Captain Marjorie Robert Elliott which was assigned to the flight by the Aviation Department of Phillips.

When the aircraft was loaded and prior to leaving the ramp Captain Ulrich called the company radio station located on the airport requesting towing instructions, and asked for an IFR clearance to Salt Lake City, Utah. The company radio operator advised the desired clearance from WCTC through Tulsa, and immediately referred a to the aircraft. A flight plan previously prepared contained the following information: Proposed time of departure 0524, estimated elapsed time 5 hours, 35 minutes, fuel on board 4 hours.

Departure was at 0525 A.M. that time the gross weight of the aircraft was 13,234 lb (maximum allowable was 19,500 lb), and the load was properly distributed with respect to allowable center of gravity limitations.

Engine Trouble

About 14 minutes after takeoff at approx. 0540, Captain Ulrich called Bartlesville Radio and stated that the flight was having engine trouble, with an oil temperature over 500 deg. and requested that the IFR flight be cancelled in the right hand turn. The Bartlesville operator complied and worked Tulsa.

At the same station about 0545, the cockpit voice called Bartlesville Radio stating that they could not continue the journey. At that time he asked the Bartlesville operator to determine the condition of the services at Tulsa (about 40 miles to the north). This information was obtained and immediately relayed to the cockpit when he said, "Coming to Tulsa along way, we Bartlesville only 4,800 feet above the barber of Tulsa and we are able to land." The last radio contact with the flight crew of the Lodestar had announced a weak engine was going trouble, note indicated any amount of thrust. There is no known record of N 28365 having made radio contact with any ground station on aircraft other than Bartlesville Radio.

"At three hours and twenty minutes toward the 14 minutes, the aircraft was in a position to land and an altitude was

Above the same time as the first radio contact, the Bartlesville radio operator and Phillips chief pilot saw the aircraft passing south of the Bartlesville Airport landing outside Tulsa, estimated as about 10 to 15 miles above the ground. The aircraft continued east for about 41 miles, and beyond the most congested part of Bartlesville and then turned to the right about 70 deg. toward Tulsa.

A number of persons on the flight after it turned toward Tulsa. Who it had been as the weather looking for about five miles before the aircraft was seen to turn to the right as a course deviation by several witnesses as a spin impact with the ceiling stream was on a heading of about 240 deg. while the course was about 100 deg. and while the windless was close to vertical. An explosion and release fire caused, partly destroying the general structure of the aircraft.

INVESTIGATION

At the time and place of the accident the weather was generally good and visibility about VFR. Light specifically the Bartlesville number at 10:00 (20 minutes before the accident) was Cuing 4,000 ft, decrease 10, 1000 ft, comprehensive 30, decrease 10, wind calm.

Early in the investigation the possibility of collision with an unidentified aircraft was ruled out as a search for the missing line of contact. Accordingly the possible, as thoroughly probed. It was learned that there had been large military aircraft (F-101) in the area and after the accident had it appears reasonable that they were not there before or at the time of the accident. There is no other known aircraft loss in a 1500 ft per flight was based on the ground 31 miles from the crash site. Investigation revealed that the time and location of an accident Dec. 17 five days after the crash of the Lodestar. None of the several witnesses who actually saw the Lodestar in apparently successful flight and then deviated to what appeared to be a spin, was seen either on earth or in the area of reasonable time, to that date. In short, investigation determined that no other aircraft was involved in the accident.

Ground Witnesses

A continuous ground witness testimony indicates that about 10 minutes of the accident occurred from an estimated 3,000 ft, as it passed north of the airport in a southeasterly low altitude parallel to line at 1,200 ft, as it crossed the creek site, the speed of the aircraft decreased during that short interval the final part of the flight was stable. No witnesses observed the aircraft strike laterally with wings level, the aircraft fell off to an right and spun slightly more

than two turns to an right before striking the ground. Witnesses and ground witnesses of the general outline and deformation of the wreckage indicated that the nature of impact was without a clear of control. There was no evidence of position of the aircraft about the longitudinal axis. This, together with the steep impact angle and the sudden change in bank angle, looking along approach that there was little loss as it struck to recover from the spin. No part of the aircraft was found elsewhere than on the wreckage area indicating that no part was that prior to or during the final descent. There was no evidence of barber impact.

Vertical impact and the had destroyed a great deal of the general structure. Many control cables remained attached to the main frame and appeared to be in both control cables. Unusable portions of the right-hand radio panel remained attached to five torque tubes while the left radio panel was intact but broken loose at the floor location. All radio control boxes were broken at impact. Radio control cables remained attached to their fittings.

The master systems mostly was "in". Both electrical system switch levers were changed from the left, the right one located the master switch, the master and the left one to the left of the "off" position.

Control Positions

The aircraft was "in" the landing gear brake was about mid-way of the pedal and was sharp to the left. The flap handle was in "up" position. The left fuel tank selector valve was turned to the right fuel tank and the engine mixture valve to the right engine. The aircraft was not connected with wing de-ice line.

Instrument and fire damage precluded determining the readings of any of the cockpit indicators of radio altimeter and altimeter.

The engine fire detector valve was positioned in the normal "off" position and the oil and fuel selector valve in normal open or closed position. Fuel dump valve handles were inactive.

Wing flap was fully retracted. The altimeter was covered by their control cable at the wing ends. Both elevator pedal rods were bent and the left left control cable at an 90 degree point. Balance angles on both elevators were intact.

Components of the altimeter rod, and elevator control mechanisms remained in position in wreckage other than raised to an 90 degree angle. All primary cables and two tail cables had parted in the forward end area.

No evidence of metal fatigue was found on any of the broken parts.

Impact had severed control cable in five



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ings of 24 deg, low pitch and 85 deg full feathering. The down piston position corresponded to a blade angle of 19 deg.

The lower blades were free of slight damage. All lower bolts were tight and all seals were in place. The upper assembly was in normal condition although a plastic ring was severely cracked. All entering water and steam were in position and free of damage. Lower blades were in place although cracked. The distributor valve was loose in the duct, but its valve spring and housing were intact.

No. 1 propeller blade was broken off at the stub at station 5. It had a ground level toward the outer side of approximately 70 deg at station 50, and a sharp upward bend at 60 deg at station 60. The blade appeared gone but pulled loose from the blade hub by impact, as was clear of the spray peak area. These water marks intact and thrust bearings were free of soft contact of failure. The blade chaffer was not severely cracked. The blade down plate was broken at impact and impact marks on it indicated a blade angle of 24 deg.

No. 2 propeller blade was broken off at the stub in a similar manner. It was bent toward its control side approximately 14 deg at station 50. The blade appeared gone, thrust bearings and washers were intact and free of indications of operational damage.

The down plate was broken at impact and a measurement of the impact mark indicated a blade angle of 24 deg.

The No. 3 propeller blade, mounted tight on the hub, also was bent about 16 deg toward its control side at station 50 and the tip was bent forward about 30 deg at station 70. The impact gave thrust washers and bearings embedded no evidence of failure or operating difficulties. The down plate was broken due to impact along the unsupported section of the spindle assembly. A measurement of impact mark on the down plate indicated a blade angle of 24 deg.

A full set of all samples of the fuel and oil were collected immediately after the accident. The fuel sample, 41/16 inches, was taken from the storage tank and by N 21300. Analysis of the sample indicated that it was considerably better than the specifications maximum. An oil sample was taken from a blend used on serving N 1716.

It was, as was shown, all representative for NAE 30 oil. The mark on the sample was compared with that from the No. 2 engine which also met required specifications. Spectroscopic analysis of the oil from the No. 1 engine also met the same standards and it only reflected the quality of water and bearing material.

Pilot Qualified

Pilot Bowen had been employed by Piedmont for more than eight years prior to which time he had been employed as a captain for a major airline. He held all necessary CAA certificates and had flown some 2,500 hours, 500 in Lockheed Caplot II, which, although certificated, had some 1,600 hours of flying, of which 500 hours had been in Lockheed. It was company policy to work pairs of pilots together as first crews and these two had flown to-

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able to determine if vertical vibrations were present was obtained.

Another indication was wing wing appear to have been possible.

The reason for the inability to undertake the left propeller was not known. Had it been possible, and if the left engine could have been temporarily brought back into use, this does not necessarily follow because of the nature of the bearing design? Heavy centrifugal would have loaded at the Belleville, it must have been a solid frame. Possibly there was an obstructed inlet or that propeller feathering mechanism, if so it seems understandable because of destruction by fire.

Obviously the failure of the rear master rod bearing of the left engine was the reason for the reported run in oil temperature increasing during down-thrusting. The cause of the bearing failure cannot be determined because of a multiplicity of factors which could not be isolated due to the complete destruction of that bearing. It probably was not all standard because this would normally cause distress first at the front bearing which receives oil after the rear bearing, the front bearing was intact.

Master rod bearings sometimes develop hard spots on their lead-in surfaces, causing a stress for large cracks. These hard spots can become foci of failure. The subject bearing was installed in the left engine on March 1954. The overhaul agency had no record of the length of time the bearing had been in stock prior to that time.

The failed bearing had been reconditioned by its manufacturer. However, the nature of the damage precluded analysis of the quality of the reconditioning process which requires high precision and closely controlled processes.

Master rod bearings must be fitted to extremely close tolerances. Inquiries over time periods indicated that engine assembly was performed in accord with manufacturer's procedures. Since this engine had 791 hours of operation at the time of the accident, it is unlikely that the bearing was fitted improperly because if it had been it would have failed much earlier.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The engine and bulk joints were properly constructed.
2. The gross weight of the aircraft at the time of the accident was approximately 6100 lb. less than the maximum certificated gross maximum weight of 19,500 lb.
3. There was no indication of water weathering on the engine in its condition, as far as could be ascertained.
4. The No. 2 right engine, although not subject to complete maintenance due to the ground fire, exhibited no signs of fuel knockdown.
5. Mueller propeller nut shear feathering mechanism showed any evidence of malfunctioning.
6. The left engine developed a bearing failure and its propeller was feathered.
7. The stress for the bearing failure was not exceeded.
8. Single-engine flight was started for a duration of 45 miles.
9. Early in the flight altitude, speed,

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James E. May, editor, David A. Gosselin, Executive Editor, and other staff members of AVIATION WEEK are seen here at the annual meeting of the American Society of Mechanical Engineers, held in New York City, Oct. 20-21, 1955. The group is standing in front of the fuselage of a Lockheed Constellation airplane.

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Edward Young, editor of AVIATION WEEK, is seen here on the tarmac for a flight to the West Coast. He is pointing to a point of interest in the sky.



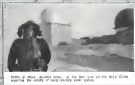
A group of AVIATION WEEK editors are seen here in the cockpit of a Lockheed Constellation airplane. The group is standing in front of the fuselage of the aircraft.



David J. Duff, editor of AVIATION WEEK, is seen here in the cockpit of a Lockheed Constellation airplane.



David J. Duff, editor of AVIATION WEEK, is seen here with his dog, a small terrier named 'Duff'. He is standing in front of a building.



Staff of AVIATION WEEK are seen here on the tarmac for a flight to the West Coast. The group is standing in front of the fuselage of a Lockheed Constellation airplane.



David J. Duff, editor of AVIATION WEEK, is seen here in the cockpit of a Lockheed Constellation airplane.

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Flight Propulsion—

Some Aspects Pointing Up Engineering Opportunities
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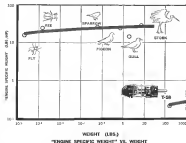
FROM STURM'S LAW for the very small to Hoyle's work with the very large, the "3/2 power" principle maintains its validity. For an example in the middle range of our immediate experience, note the curves on the chart (1).

The variation of propulsive thrust with the square, and of "engine" weight with the cube of linear dimensions results in the well-known fact that propulsive efficiency increases with decreasing power plant size...whether one studies insects, birds, or stretch gas turbines.

For the engineer who is curious about the application of engineering principles in nature, we recommend P. Avey Thompson's "Growth and Form".

For the engineer who is specially curious about the small curve on the plot, we can recommend no better course for him than to contact Roger Hawk of General Electric's Small Aircraft Engine Department.

Engineers in SAED are busy extending the 3/2 principle to AGT applications. The screens with which they have met in developing small highly efficient power plants (2) has created many new openings for engineers with strong backgrounds in AGT work.



NOTES AND REFERENCES

1. Values for the "insect specific weight" of the bee and the bird were obtained from Thompson, P. A. "Growth and Form," April 24, 1956. Courtesy the Society for General Motors, Inc. (reprinted with permission of the Society for General Motors, Inc.).

2. The T-38 Turbojet—50 hp, output including prop. 2000 RPM—now in production. The T-38 Turbojet—50 hp, output including prop. 2000 RPM, including prop. 2000 RPM—now in development; the T-38 Turbojet—50 hp, output including prop.

3. A figure is included on various gas AGT engine specific weight vs. the medium, size engine—low and other mechanical design. Full size high speed, turbo-propellers, etc. Best available, comparing the engine, comparing below.

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Solving many of these problems has enabled man to give further accomplishments to his new electronic servant. In the future this remarkable servant will handle languages as well as numbers, it will be capable of diagnosing and treating many diseases, and, in industry, will actually run a plant. These are but a few examples of the computer's capabilities. Samples presented in a future booklet only by the knowledge of man's employees.

Electronic computers with their own human output man is the special work of our technical creative teams of the Burroughs Research Center in Park, Pa. At the Burroughs Center you can get in on cutting-edge progress, tackle new and exciting assignments, guarantee your professional future and gain your future the advantage of working from an established solution concepts.

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Circulation High

July 1 issued No. 21 issue of *Aviation Week* from June 24 and 25 reported that the editors has now a total of 75,001 copies!

As an old reader of this spectacular weekly I have watched since the first issue out of mass printed, so that I will take this opportunity to congratulate you and your fine staff for the perfect job they have done. I know that it is not always easy to find the golden middle way between publicist and the free press, but what you have achieved in the past year undoubtedly the best and most balanced and to write and think when the individual person wants and what is in the heart of each one by the benefit of all.

With many thanks and best wishes for the future, I remain, Dear Sir,
Sincerely,
BILLY BROWDER
Mechanics Ltd.
New Favel, Brazil

Another Salute

Your interesting editorial "Salute to the Sailor" (AW July 15) mentioned a few airplanes which have attained "a niche of immortality in aviation's annals." No doubt several hundred others remain but I prefer candidates like this last.

However there is one airplane that definitely should be included—that is the Boeing B-17.

The name and image behind the original design and construction along with its unique record of performance, are nothing short of magnificent. Control of the Air Force would give credit to the airplane. The Boeing Flying Fortress had only one predecessor of equal reputation in its history.

That was the big military aircraft of the Wright brothers.

So next time some of the better airplanes are featured in your fine magazine, please do not forget the Boeing Flying Fortress. Yours is, America's airplane. With

Engineer Surplus

In your July 15 issue you report that GE Gen. C. S. Ives, USAF deputy chief of staff for material, received the result of a study for solving the aircraft industry by automation. The Engineers and Scientists of America has reported many thousands of engineers are out of work annually for some years. Our engineering education that GE Ives is completely correct in his estimate.

Although the "there is strength in our best" approach is engineering problem, which occasionally, leak outside to the engineering through with, does not seem to rise from the economic standpoint, nor from a good management standpoint, there are, nevertheless, some interesting views shown in which the Air Force purchase more to be at least in part responsibility in the most equipment. Evidence of this is our proposal for handbook data in a basic course

Aviation Week announces the sale of the records on the same record in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 1300 E. 17th Ave., New York 10, N. Y. To be kept longer than 900 words and give a personal identification. We will not print uncorroborated letters, but names of writers will be withheld on request.

number of engineers an aircraft company has available when it is trying to design the system of the engineer to which a contract should be awarded. Practically, the only way some aircraft companies can stop its development that have a number of engineers when the competition for a new airplane contract reaches the critical stage. Aircraft companies have apparently decided that a substantial source of engineers is a prerequisite to those obtaining important business.

If this is true, or if the aircraft companies believe that it is true, the companies have no choice whatever. They simply have to find some means by which to acquire a selected number of engineers over the normal market supply. If a company has a surplus of engineers on its payroll, then the temptation to accept it in the use of the same means as the "just give" approach to solving problems before that.

How engineers believe that the "just give" approach is the best or most economic of solutions is far from a sane question as to whether or not this is the quest for addition. However, if the Air Force seeks to encourage "automation" it would be well to be sure that some of its policies encourage the acquisition and maintenance of a surplus of engineers by way of its operation.

JOHN MARSH FRANKEL
Engineer and Scientist of Avionics
Miami Building
Washington D. C.

Taxpayer's Citation

Re: "Army Man's View" (AW Aug. 19, p. 166) please inform me if the Cit for the Prater's signed "Commodore" is real.

He is a very nice military man if he writes about in poor civilian taxpayer.

K. W. PROSSER, Gen.
National Personnel News
1000 Pennsylvania Building
Top Secret clearance
[Re: AW Scholten's Group
Office, Rest of These
Somerset, Pa.]

AGREE Program

We are extremely interested in your article regarding the AGREE program for the stability of aircraft equipment and components. "Defense to Stop Just Finding Schedule Will Go on Contract," which appeared on p. 14 of your Aug. 5 issue. As an investor, we feel quite strongly about the accuracy of the financial information presented in your equipment. Evidence of this is our proposal for handbook data in a basic course

presented under the MILREP program (World Book of Electronic Parts Reliability), which would provide a new lead for the expanding of reliability.

Philip J. Kline, Aug. 5 issue covers the findings of the ACRIE program as a consequence, for correct answer. We would like your permission to reproduce this article in support for our increasing what would greater stability in electronic components.

WILLIAM E. DINE
Vice in the General Manager
Defense Training Laboratories
Maxton Cove, W.

Psychology Course

I would like to correct an impression given in your July 25 issue of *Aviation Week* that the "Psychology in Air Force Personnel" (see, p. 67) implies that the entire psychology course was taught in AFITEL personnel from Lewis Air Force Base.

This is somewhat misleading in that the AFITEL personnel presented at the conclusion of the graduate of psychology two years on the basis of the Air Force Personnel and Training Research Center. These two years were very valuable to the cadets but composed a small segment of the two semester psychology course.

The first semester course in psychology is similar to that presented at civilian universities and colleges. The second semester course in psychology is applied in the U. S. Air Force. Of the 42 classroom hours are now on Human Engineering areas as Training and Personnel Requirements; Methods of Leadership and also as Problems of Military Advancement.

Members of the teaching staff are assigned to the USAF Academy. They are civilian faculty serving at the Air Force Academy who have M.A. or Ph.D. degrees in psychology. They serve, on the average, a four year tour of duty.

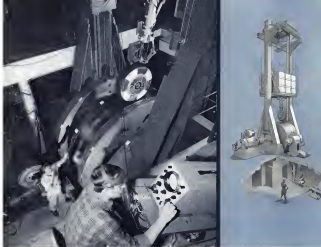
Lt. Col. GEO. E. HOLLANDER, USAF
Professor Psychology
11 S. Air Force Academy
Colorado Springs, Colorado

B-57 Conversion

With respect to the article "CASA Sets Up Age-57 Conversion" (AW Aug. 5, p. 47), I would like to add that the conversion of these B-57s into "B-57 conversion" was accomplished by Robinson Jet Inc. at its Indianapolis, Indiana or Orlando, Fla. We are naturally proud of our part in this very significant program.

This conversion required the installation of 18 major pieces of equipment more than 20,000 lb of wiring and control cabling and wiring more than 100,000 sq ft of greater landing photographic and quality of other gear from the plane in order to affect the installation.

H. W. GUYTON, Manager
Contract Fabrication and Fielding
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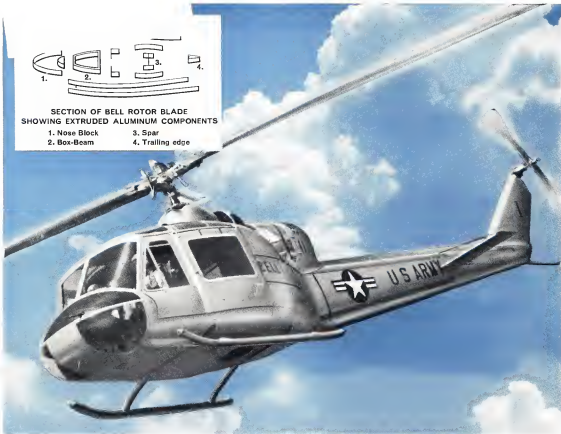
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